THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXV. No. 871.] LONDON, JANUARY 20, 1880. [32nd Year.] Price 6d.

GAS PURIFICATION
BY
OXIDE OF IRON.

COOKE BROS.,
CENTRAL DEPÔTS:
CO. DONEGAL, IRELAND;
LONDON DEPÔT:
BLACKWALL, E.;
OFFICES:
26, 27, & 28, FENCHURCH ST.,
LONDON, E.C.

GENUINE TORBAY PAINT
And SPECIAL GASOMETER PAINT.
Several Prize Medals. Established over 20 Years.
These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.
Supplied, mixed ready for use, or in paste, as desired.
TORBAY PAINT COMPANY.
Proprietors: STEVENS & CO.,
21, GREAT WINCHESTER STREET, LONDON.
Works: BRIXHAM, TORBAY.

THOMAS PROUD,
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.
CONTRACTOR FOR
LAYING MAINS
FOR
Gas, Water, & Sanitary Purposes,
AND MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL & CO.,
LIMITED,
Established at the commencement of Gas Lighting,
Manufacturers of
TUBES AND FITTINGS.
THREE PRIZE MEDALS,
Paris, 1878.
Head London Office:
145, QUEEN VICTORIA STREET.
ALMA TUBE-WORKS, WALSALL;
OLD PATENT TUBE-WORKS, WEDNESBURY.

JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
Manufacturers of
WET AND DRY GAS-METERS,
Licensees and Manufacturers of
HUNT'S
PATENT COMPENSATING METERS
STREET-LAMPS, &c., &c.
Established 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
Manufacturers of
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
London Offices: 97, CANNON STREET—
JAMES E. & SAMUEL SPENCER, Agents.

THE
"OTTO" GAS-ENGINE.
See Page 82.

CROSSLEY BROTHERS,
MANCHESTER AND LONDON.

THE
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.
AGENT:
JAMES M'KELVIE,
HAYMARKET,
EDINBURGH.
ESTABLISHED 1840.

CHANGE OF ADDRESS.

GEORGE GLOVER AND CO.,

DRY GAS-METER MANUFACTURERS,
HAVE REMOVED TO MORE EXTENSIVE PREMISES:

RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

WELLINGTON TUBE WORKS,

GREAT BRIDGE, TIPTON, STAFFORDSHIRE.

JOSEPH AIRD,

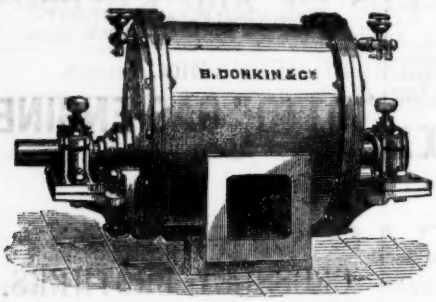
GAS, STEAM, AND HYDRAULIC TUBES AND FITTINGS.

HONOURABLE MENTION, **J. E. WILLIAMS & CO.,** PARIS EXHIBITION, 1878.

SOLE MANUFACTURERS OF THE

SPECIAL METALLIC OXIDE PAINT,

VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.



J. BEALE'S
NEW PATENT GAS-EXHAUSTERS,

For the Manufacture of which

MESSRS. B. DONKIN & Co.

POSSESS THE SOLE RIGHT.

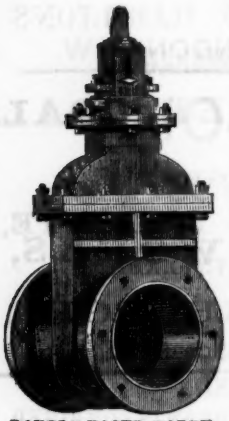
Made with two Outside Bearings and with all the Latest Improvements.

FULL PARTICULARS ON APPLICATION.

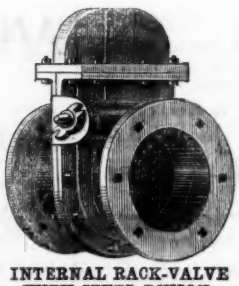
BERMONDSEY, LONDON, S.E.

Messrs. B. D. & Co. are also Manufacturers of Steam-Engines and of Improved Gas and Water Valves, &c., &c.

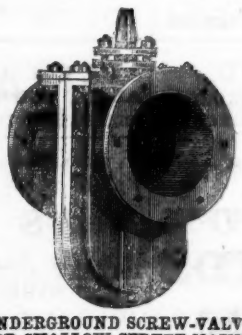
C. & W. WALKERS' GAS-VALVES.



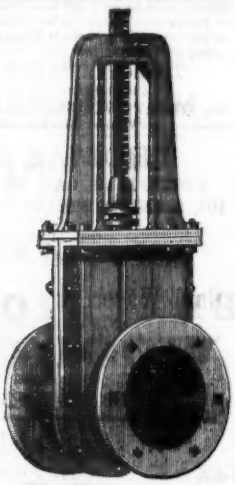
DOUBLE-FACED VALVE SPECIALLY FOR PURIFIERS.



INTERNAL RACK-VALVE WITH STEEL PINION, FOR GENERAL USE.



UNDERGROUND SCREW-VALVE FOR SHALLOW STREET-MAINS.



ORDINARY RACK AND PINION VALVE.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.,

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM.

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

LONDON OFFICES: 97, CANNON STREET—JAMES E. & SAMUEL SPENCER, AGENTS.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

HANNA, DONALD, & WILSON,

(ESTABLISHED 1851,)

GAS ENGINEERS & CONTRACTORS

FOR THE

ERECTION OF GAS AND WATER WORKS,

TELESCOPIC AND SINGLE-LIFT GASHOLDERS,

CAST AND WROUGHT IRON GASHOLDER-TANKS,

IMPROVED FIXED OR TRAVELLING HYDRAULIC PURIFIER-COVER LIFTERS,

PURIFIERS, CONDENSERS, SCRUBBERS, EXHAUSTERS, AND PUMPING-ENGINES,

TAR AND LIQUOR PUMPS, HYDRAULIC SLUICE AND SLIDE VALVES, LAMP-POSTS AND HYDRANTS COMBINED.

DESIGNS AND ESTIMATES SUPPLIED ON APPLICATION.

London Office: 9, FENCHURCH STREET, E.C.

ABERCORN FOUNDRY & ABBEY WORKS, PAISLEY, N.B.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER AND BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM (Established 1765),

MANUFACTURER OF

TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST-IRON TANKS FOR DITTO.

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, AND ALL KINDS OF GAS APPARATUS.

WROUGHT-IRON ROOFS, BRIDGES, GIRDERS, ETC.

STEAM, HOT WATER, AND RANGE BOILERS, TANKS, CISTERNS, BOATS,

AND ALL KINDS OF WROUGHT-IRON WORK.

Drawings, Specifications, and Estimates supplied on application.

GAS PURIFICATION
BY
OXIDE OF IRON.
GAS PURIFICATION & CHEMICAL Co., LIMITED,
PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

G. J. EVESON

Has on Sale a large quantity of Cannel, South Yorkshire, Wigan, and Ruabon Coal, purchased previous to the late advances.

Prices on Application.

GAS COAL AND CANNEL CONTRACTOR, BIRMINGHAM.

HYDRATED PURIFYING MATERIAL.
Samples on application.

MESSRS. SPENCE BROS., LIMITED,
Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.

PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

ROBT. DEMPSTER & SONS,
GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;
CONTRACTORS FOR THE

ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.
MANUFACTURED BY GUEST AND CHRIMES,

FOUNDRY AND GENERAL BRASS WORKS,
ROTHERHAM;
AND 85, SOUTHWARK ST., LONDON, S.E.

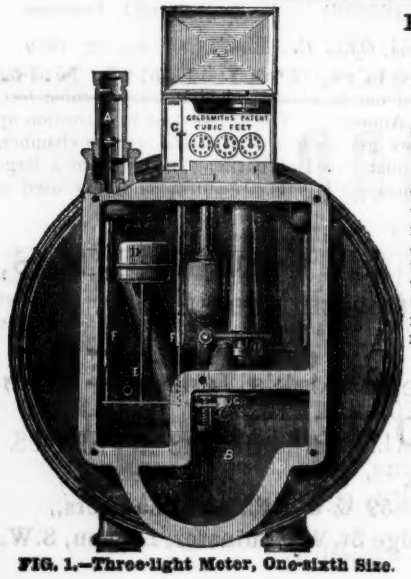


FIG. 1.—Three-light Meter, One-sixth Size.

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

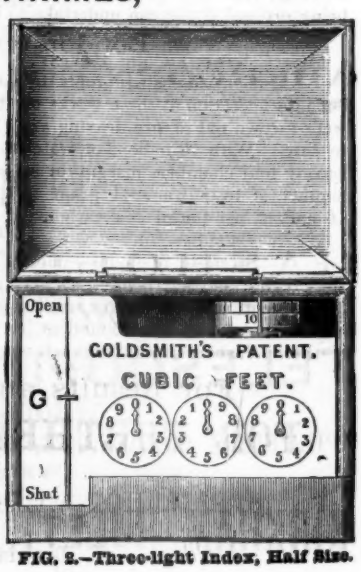


FIG. 2.—Three-light Index, Half Size.

KIRKHAM, HULETT, & CHANDLER, LIMITED.

PATENT "STANDARD" WASHER-SCRUBBER,

FOR

GAS PURIFICATION,

TAKES OUT EVERY TRACE OF AMMONIA AND A LARGE QUANTITY OF CARBONIC ACID AND SULPHURETTED HYDROGEN BY ONCE PASSING THROUGH THE MACHINE.

AMMONIACAL LIQUOR OBTAINED OF ANY REQUIRED STRENGTH.

The Cost of the Machine defrayed by the Ammonia obtained in Twelve Months.

It requires very little attention, and cannot get out of order.

THESE MACHINES HAVE BEEN SUPPLIED TO THE FOLLOWING GAS-WORKS:—

	Feet per Day.
The Gaslight Company, London—	
Beckton	5,000,000
Bromley	7,000,000
St. Pancras	3,000,000
Bradford Corporation	1,000,000
Bremen	150,000
Buxton Local Board	250,000
Dukinfield Local Board	500,000
Driffield Company	100,000
Goole Company	250,000
Glossop Company	300,000
Holywood Company	125,000
Heywood Local Board	600,000
Leeds Corporation	2,000,000
Leominster Company	150,000
Maidstone Company	1,000,000
Phœnix Company, Greenwich	2,500,000
" " Vauxhall	3,000,000
Woolwich Equitable Company	400,000
Yeadon Company	500,000

AND MANY OTHERS ARE IN COURSE OF CONSTRUCTION.

TESTIMONIALS.

Messrs. KIRKHAM, HULETT, and CHANDLER. *Engine-Works, Millbank, Westminster, S.W., March* 5, 1879.

Gentlemen,—In accordance with your instructions, I have taken diagrams from Vertical Engine driving your Patent Horizontal Washer-Scrubber to purify 60,000 feet of gas per hour on the works of The Gaslight Company at King's Cross, and find the following results, viz.:—

Horse power required to drive engine, shafting, and gearing alone	= 0·398
Total horse power with washer on	= 1·721
Absolute horse power required to drive Washer-Scrubber	= 1·323

(Signed) THOS. HORN.

Messrs. KIRKHAM and HERSEY. *The Gaslight and Coke Company, Bromley-by-Bow, E., June* 2, 1879.

Gentlemen,—I have much pleasure in stating that the results of the working of Kirkham, Hulett, and Chandler's Washer-Scrubber, erected at these works in 1877, have been perfectly satisfactory, and that the two erected last year are doing well—all that you guaranteed; indeed, the effectiveness of the machine is so convincing, that I am induced to recommend another being ordered if you can undertake to have it erected complete before next winter. (Signed) W. B. WRIGHT, Engineer.

Messrs. KIRKHAM and HERSEY. *Phœnix Gaslight and Coke Company, Office, Greenwich, S.E., Aug.* 12, 1879.

Gentlemen,—In reply to your inquiry, one of your Patent Scrubber-Washers to purify 100,000 cubic feet per hour was put into operation at these works on the 1st of June. At the same moment the whole of our Scrubbers, equal to 28,000 cubic feet, were thrown out of use, leaving your Washer the whole work of freeing the gas from Ammonia. This it has done to perfection up to date. With 10 gallons of water to each ton of coal carbonized passing through it we get a clean test at the seventh chamber, leaving four chambers margin for extra work. The mean quantity of Ammonia in the inlet (fixed and free) obtained from a large number of tests was 241 grains per 100 feet of gas. On the outlet—Free Ammonia—Nil. The quantity of water used is 10 gallons per ton of coal carbonized. The strength of liquor as follows:—

Chamber No.	1	2	3	4	5	6	7	8	9	10	11
Strength of liquor—ounces	Nil.	Nil.	Nil.	Nil.	0·4	1·0	2·2	3·5	5·5	8·25	1·25

We are working five revolutions per minute. It takes out all the free Ammonia, reduces the carbonic acid and sulphuretted hydrogen 30 per cent., requires a very small amount of power to drive, and altogether is, in my opinion, the best machine for the purpose yet invented, and will, I feel confident, ere long, entirely supersede the Scrubbers of to-day. I am glad to find you are going to fix one of these Washers at our Vauxhall works. (Signed) P. J. WATES, Engineer.

For Results and other Testimonials, see next week's Journal.

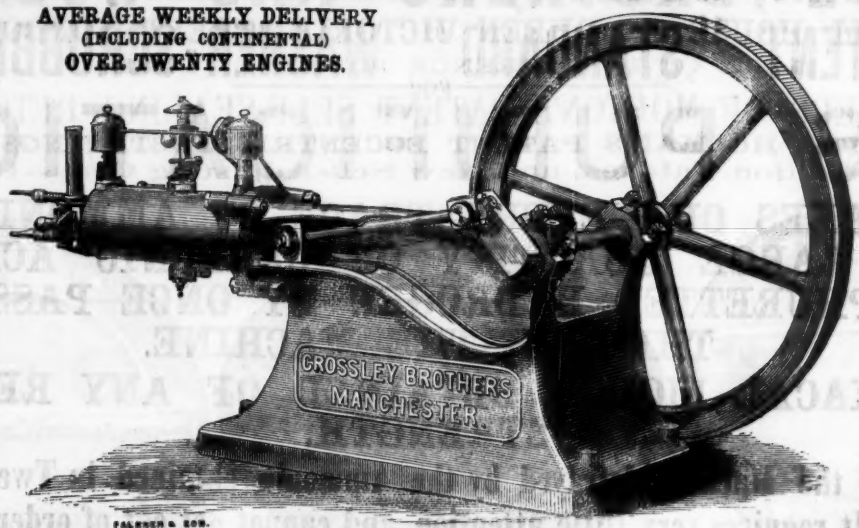
FOR FURTHER PARTICULARS AND TESTIMONIALS, ADDRESS MESSRS.

KIRKHAM, HULETT, & CHANDLER, LIMITED, { 59 & 60, Palace Chambers, Bridge St. Westminster, London, S.W.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

AVERAGE WEEKLY DELIVERY
(INCLUDING CONTINENTAL)
OVER TWENTY ENGINES.

The durability of these Engines is now established by experience, one of them having run night and day at the Hinckley Gas-Works for over Twelve months without any expenditure for repair; this being equal to about 2½ years average work.



Over 1900 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

No trouble with Coal, Ashes, Smoke, Insurance, Water, or constant attendance.

No Glands to pack, or Water Gauges and Steam Gauges to watch.

STARTS AT A MOMENT'S NOTICE.

THE "OTTO" SILENT GAS-ENGINE.

(Otto and Crossley's Patents, 1876 and 1877.)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER. SIZES { NOMINAL HORSE POWER ½ 1 2 3½ 6 8 12 16 / MAXIMUM HORSE POWER ¾ 1½ 2½ 4 9 12 18 24 } OFFERED. CASES NOT CHARGED IF RETURNED FREE.

PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES).

WORKS AND HEAD OFFICES: Gt. Marlbro' St., Gloster St.

CROSSLEY BROTHERS, MANCHESTER.

LONDON HOUSE: 116, Queen Victoria St., E.C.

THE NEW GAS COOKER.

40 PER CENT. OF GAS SAVED.

No. A510 same as our **No. A152,**
But Lined with Patent Non-Conductor.
Will Roast, Bake, and Fry, and with Three Burners for Boiling.

SIZE.
Outside—30in. high, 20in. wide, 20in. deep.
Inside—19½in. „ 14in. „ 17in. „

Price . . . . . **£4 14s. 6d.**

No. A500.
Lined with Patent Non-Conductor.
Is fitted with Roasting and Baking Oven and Four Burners for Boiling.

SIZE.
Outside—34in high, 20in. wide, 19in. deep.
Inside—30in. „ 16in. „ 17in. „
Hot Plate—24in. by 23in.

Price . . . . . **£7 10s. 0d.**

No. A505.
Same as with Roasting and Baking Oven, a Broiler or Toaster, a Chop Griller, a Hot Water Boiler, and Three Burners for Boiling.
Hot Plate—26in. by 24in.

Price . . . . . **£9 15s. 0d.**

These Cookers are jacketed, on the sides, top, and door, with a new and very efficient non-conducting material, by the use of which a **saving** of gas to the extent of **40 per cent.** is effected.

Gas Companies who are selling or hiring stoves should see these stoves. Catalogues and particulars on application to

JOHN WRIGHT & CO., ESSEX WORKS, BROAD STREET, BIRMINGHAM.

London Warehouses: 155a, Upper Thames Street, 1, Little Bush Lane.

TANGYE BROTHERS AND HOLMAN,

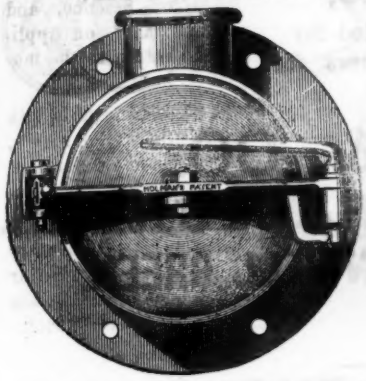
CORNWALL HOUSE, 35, QUEEN VICTORIA STREET, LONDON, E.C.,

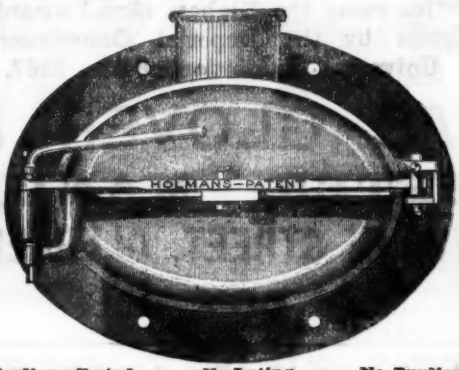
(LATE OF 10, LAURENCE POUNTNEY LANE.)

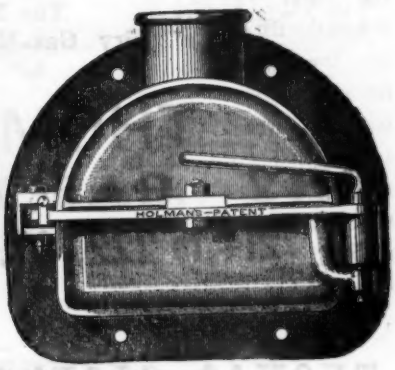
SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.







Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland)

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

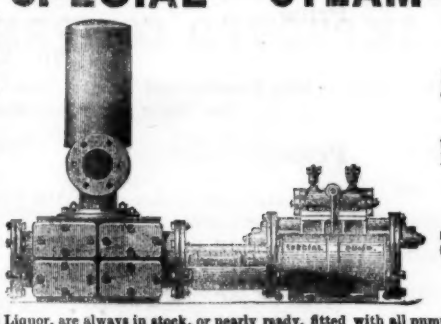
Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	21
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

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PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters bv the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS.

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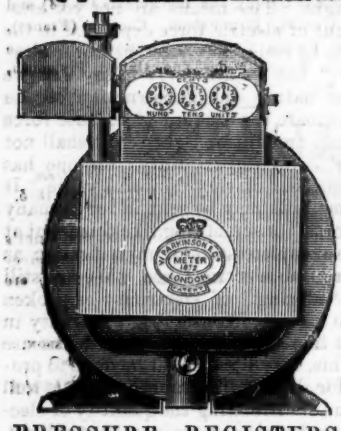
THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.,

(ESTABLISHED 1816,)

MANUFACTURERS OF



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STATION-METERS & GOVERNORS,

EXHAUSTER REGULATORS,

PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

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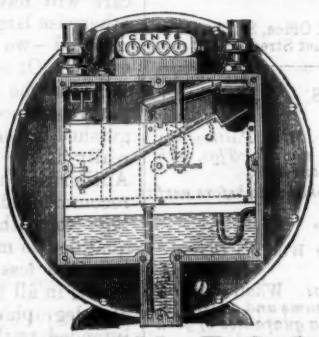

The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

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COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO SUBSCRIBERS.

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Covers for binding the Volume (No. XXXIV., July to December, 1879) may be had, on order, from any bookseller, or direct from the office—price 2s. 6d. each.

Post Orders to be made payable at the Chief District Office, St. Martin's-le-Grand, London, to Walter King, 11, Bolt Court, Fleet Street, E.C.

TO CORRESPONDENTS.

THE HYDRAULIC MAIN.—*We have received from Mr. R. H. Patterson a "Postscript" to his two recent articles on the above subject. This, with the illustrations which accompany it, will appear next week.*

R. B. and S.—*The subject you mention shall be looked into before next issue.*

J. H.—*Thanks for letter, re "Frozen Lamp Services."*

RECEIVED.—*"Hot Air, v. Hot-Water Baths for the Working Classes." By Richard Metcalfe.*

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 20, 1880.

Circular to Gas Companies.

ALL the gas-works undertakings in the kingdom belonging to Companies have not yet been transferred to Local Authorities, as we are told will be the case within a comparatively short period of time. For the present session we find only two Bills to confirm agreements already entered into between Local Authorities and Gas Companies for the transfer of their undertakings, and one (Cork) which offers a Corporation the opportunity of absorbing the works within a period of three years. On the whole, we think it will be admitted that the Companies whose dissolution we notice to-day have been very fairly dealt with by the Authorities to whom they transfer their undertakings. The Hinckley Gas Company, for example, receive about £175 for every £100 of invested capital; and this, it must be admitted, is a good price for the undertaking of a non-statutory Company. Supposing the Hinckley Company to have been incorporated, they would have been in a position to command twenty-five per cent. more; and it is for reasons such as this that we constantly urge the desirability of Companies becoming possessed of statutory powers, especially in cases where the probability of purchase is to be considered.

The terms obtained by the Lancaster Gas Company—a statutory one—are, of course, better. In this case the Company receive £80,000 for £30,000 expended, or £266 per £100 of invested capital. This is a little above the recognized price for a statutory undertaking. The Company is, however, of much antiquity and great stability, and the price the Shareholders have obtained is rather below than above the real value of the undertaking. The Corporation will soon find that they have secured an excellent bargain, which there is no doubt will turn out extremely profitable.

The remainder of the Bills we have to notice in relation to illuminating purposes are those promoted by Local Authorities mainly with the object of obtaining power to furnish the electric light. To make use of this light is, at present, to them an object of extreme anxiety. Unfortunately, many Local Authorities envy Gas Companies in the profits they earn. All we can say is that they are welcome to every farthing they can make out of the electric light. The means are not yet established by which the amount of electric force expended in the production of the light is to be estimated. In the Bills, however, we read of "meters;" but we are sorry to say that we are as yet ignorant of the nature and construction of the instruments intended to estimate the amount of electric force that is used to give a certain amount of light. We shall not say that an electric meter is an impossibility; for one has been proposed by Mr. Edison, but of very doubtful value. It may be that in times to come bills may be sent in for so many "Ohms" and so many "Farads," or something like this; but at the present day we are in a complete state of mystification as to the appliances for valuing the electric force. We are still more mystified when the "storing" of electricity is spoken of. So far as we know, no means of conserving electricity in quantity is possible, except in a Leyden jar; and with the use of such an instrument as this, very little could be done to promote the use of electricity for illuminating purposes. It is well that while we have no means of estimating the quantity of electricity which must be circulated to give a certain amount of light, the Corporations from whose Bills we are quoting should arrange that all charges for the light should be fixed by agreement. This will be a very sensible proceeding, but we think that care will have to be exercised in drawing up agreements, otherwise large loopholes will be left through which the illuminated—we can hardly say, in this case, consumers—will escape. Of course, to work the electric light it will be necessary for the Corporations, &c., to acquire authority to use patent licences—even one of Mr. Edison's, if that distinguished inventor should ever advance so far as to make a really useful invention. Whilst waiting for this, the Local Authorities may avail themselves of such patents as are recommended to their notice. It is, no doubt, a great advantage to both Companies and Corporations to be legally qualified to make use of patent rights; but all we can say is, that the less they have to do with them the better. Necessarily, in all these Bills a clause is inserted for the protection of telegraphic wires from the inductive action of the wires intended to illuminate, as they carry so much more powerful

a current. It is to be regretted we have as yet no positive information as to the exact influence which one wire may exert on another at certain distances. This is a point that should be determined at once, and we may especially refer it to the notice of Mr. Preece. If little or no disturbance occurs, there is no reason why the two wires should not travel side by side, and so save a large amount of pavement disturbance.

We are not at all disconcerted or alarmed at the fact that the use of the electric light is spreading among certain trading establishments in the Metropolis. There are now several business houses in which the light is used, either for purely illuminating purposes, or as an advertisement. The last display made of it—that at Messrs. Samuel Brothers, of Ludgate Hill—is somewhat of a failure. The pedestrian may go three or four doors beyond the place, and see a shop, devoted to the same description of business, illuminated by gas, and he will immediately recognize the immense superiority of the latter illuminant. In this most recent display brought under our notice, a Crossley's "Otto" gas-engine of twelve-horse nominal power actuates a Gramme dynamo-electric machine, which furnishes the electric force to thirteen lights on the Jablochkoff system. Here we have a practical illustration of the beautiful simplicity of a gas-engine applied to furnish motive power. It is only necessary to light a jet of gas, give a few turns to the fly-wheel, and the action of the machine proceeds by the aid of the consumption of the gas which is supplied to it. It will be seen that these engines require none of that expensive attendance and those disagreeable surroundings consequent on the employment of steam. They are, in fact, at this moment the most useful engines in existence. The latest application of a gas-engine we have heard of, is for pumping sewage at Middlewich, Cheshire.

It is absurd to expend too much force in breaking a butterfly on a wheel, but this we think has been done in an article which we reproduce elsewhere from the *Saturday Review*. There can be no doubt that Mr. Edison is a genius of a certain kind. That he has failed to make the electric light a domestic illuminant, can hardly be considered surprising. He has, however, we presume, done the best he could, by furbishing up old inventions, to give an appearance of novelty to worn-out notions. Thus, one after another of Mr. Edison's crudities have dropped out of recognition. By the aid of newspaper correspondents they have been made, in the hands of speculators (we are here speaking only of the electric light) the means of depreciating to a serious extent the value of gas property. We do not, however, expect that Mr. Edison will harm us much more. Reports of inventions brought from so great a distance as Menlo Park, U.S.A., should not scare gas shareholders until something decided and pronounced has been sent to verify the statements put forward by Mr. Edison's supporters. In the meantime, it is in the highest degree satisfactory to see that no sooner have the American "bears" brought down the price of gas stock, than at a bound it returns at once to its legitimate value. This has been the case in the two "scares" which have so frightened the holders of English gas stock, and so successful have been the tactics of these unscrupulous speculators, that we are informed by a financial journal that as much as from six to eight per cent. has been realized by them. We cannot believe that in the course of this jobbery much stock passes from the hands of real investors. The prices quoted, no doubt, represent transactions which are peculiar to the Stock Exchange. If we thought that real investors had, upon such representations as have been made respecting Mr. Edison's discoveries, been induced to part to any great extent with their savings, we could express no pity for them; but might, in fact, rejoice that the property had fallen into the hands of some who know better how to take care of it. We hope, however, that this business is entirely at an end. Mr. Edison admits that his last pretended discovery is a signal failure, and unless *The Times* spreads abroad more audacious statements, obviously designed to frighten gas proprietors, it will, we think, be a long time before we hear any more of these misleading American telegrams.

We do not yet know whether the scheme for the amalgamation of the Phœnix with the South Metropolitan Company has received the sanction of the Board of Trade. The opinion of the Board is, we know, strongly in favour of combination, and, seeing that the scheme has been modified to suit their views, we imagine that their approval will very shortly be expressed. The opposition which has been made by the two Vestries in the district of the South Metropolitan Company has been of an almost puerile and selfish character, so much so that we cannot for a moment suppose that the Board of Trade will be in the least influenced by the representations made in their memorials. We look forward, then, to an early announcement that the Board of Trade have sanctioned the scheme, and the immediate confirmation of it by the Privy Council may be looked upon as a matter of certainty. We shall not speculate on the probable consequences of this. The Bill promoted by the Phœnix Company will, in all probability, be dropped; that of the South Metropolitan Company will then, as a matter of course, go forward. It is hardly to be disguised that the latter Company will be a little handicapped by their union with the Phœnix; but we have no doubt they are well able to carry the weight, and will pull through with triumph.

We notice that the Chelsea Vestry are making an endeavour to persuade the Metropolitan Board of Works to avail themselves of the opportunity presented by the promotion of a Bill by the London Gaslight Company, to obtain the insertion of a clause for compelling the Company to supply sixteen-candle gas. Whether the Board will take any action in reference to the matter remains to be seen. As a fact, the London Company now continually supply gas having an illuminating power close up to sixteen candles, and sometimes above that standard. We can hardly suppose, therefore, that the gas consumers in Chelsea will be benefited by any action their Vestry and the Metropolitan Board of Works may take. The time will come when the London Company will have to submit to legislation more modern than that of 1860. Then will be the time for the Authorities to bestir themselves; but then the "stir" will not be needed, as no Bill of the Company's could be successful which is not drawn upon the now established lines. In the meantime, the London Company ought really to consider whether they might not improve their position by dividing their disjointed undertaking, and enter into combinations north and south of the river.

The Long Eaton Gas Company, Limited, are making application to the Board of Trade for a Provisional Order, and the opportunity is being seized by a section of the ratepayers of the place, and some members of the Local Board, to force the Company to sell their undertaking to the Local Authority. The opinion seems to be that gas is too dear in the district (it is 4s. 2d. per thousand feet) and that the Board might sell it much cheaper. On this point, not being acquainted with the circumstances of the case, we cannot here give an opinion; all we know is that the terms which are reported to be talked about in the district are utterly inadequate. For £5 shares £8 is spoken of as the price; but it is clear the Company could not accept such compensation for an undertaking now paying large dividends.

The Corporation of Birmingham do not get on happily with all the outlying districts whom they supply with gas. A complaint is made, but certainly not with justice, of the quality of the gas furnished. Some districts, too, are dissatisfied with the quantity supplied. To remedy this, the Corporation are laying larger mains in one of the districts, and hereupon an uproar occurs. Birmingham will, of course, continue their work notwithstanding, and in the long run, we have no doubt, Oldbury and Langley will be much benefited. In the meantime, it suits the purpose of some persons to keep up an agitation against the Corporation of Birmingham. Smethwick appears to be perfectly satisfied, and indeed acknowledges the liberality of the Corporation in offering to part with the Board's portion of the undertaking as soon as they are in a position to manufacture gas.

Reduction in the Price of Gas at Staplehurst.—At a recent meeting of the Directors of the Staplehurst Gas Company, it was decided to reduce the price of gas, as from the 1st inst., from 6s. 8d. to 5s. 10d. per 1000 feet.

Yesterday's Prices of Gas and Water Shares.—Mr. A. G. Prater, Stock and Share Broker, of 23, Cornhill, gives the following as the closing prices yesterday of some of the principal gas and water shares:—

Gas Companies.

Commercial	180 —183
Continental Union	17½— 18
Crystal Palace District	173 —176
European	17½— 18
Gaslight and Coke "A"	181 —183
Imperial Continental	179 —182
London	178 —182
Phœnix	35 — 36
South Metropolitan	190 —200
Do. do. "B"	183 —185

Water Companies.

Chelsea	187 —192
East London	191 —194
Grand Junction	112 —115
Kent	258 —262
Do. New, £5 paid	10 — 12 pm.
Lambeth	194 —198
Southwark and Vauxhall	182 —185
West Middlesex	173 —176

Water and Sanitary Notes.

THE speculation in the shares of the Metropolitan Water Companies has for the moment ceased. A considerable decrease was noted in the latest quotations, the reason for which is not very apparent. A rumour is abroad that Mr. Cross has been frightened by the long price put on the undertakings by his own valuers, and there is a suspicion in some quarters that the purchase will not be proceeded with. We put no reliance at all on these statements, conjectures, or whatever they may be called. The Home Secretary is so far committed that he must go on, and leave Parliament to decide whether a purchase shall be made or not. It seems to be admitted that the position taken up by Mr. Cross, when he announced that the undertakings would be purchased at the prices which obtained last July, is perfectly untenable, and in the face of it a wild speculation set in which brought up the prices of the Companies shares some thirty or forty per cent. This shows what little faith was put in the possibility of the Government carrying out an uncommercial transaction. The astute speculators of the Stock Exchange saw at once that if the Water Companies were bought up, they must be paid for at the current value of their shares when the purchase was effected; and, willing enough to exchange water stock for Government securities, they were nevertheless anxious to secure all the advantages which could be derived from the exchange. Thus, as we have said, water stock went up, notwithstanding the report of Mr. Cross's speech. It has since receded somewhat in value, but still stands much higher than it did when the Home Secretary made his now celebrated announcement. It was, perhaps, an illustration of rash speaking which induced the Home Secretary to make the statement he did; but having made it, he must put up with the consequences. An effort has been made by an eminent firm of auctioneers to show that the words of the Home Secretary do not bear the interpretation which has been put upon them; but Mr. Cross is an eminently clear speaker. He never leaves his hearers in doubt as to the meaning his words are to bear, and we take it that in this case, led away by a desire to close the debate which was growing irksome, he made the statement to which so much objection has been raised. We shall not, however, have long to wait for explanations. Parliament will shortly meet, and this Metropolitan water business must, of necessity, form one of the first attempts of the session at domestic legislation. In the meantime we shall this week learn the value put upon water property by the public. The Grand Junction Company are about to issue £50,000 of the capital they have power to create under their Act of 1878. This will be put up to auction on the 22nd inst., and the public will then have an opportunity of expressing a practical opinion on its value. Recently the price of the £50 shares of the Company, entitled to seven per cent., was 116¼. Since then they have declined but a mere trifle. The same shares stood at 87½ last July. It is perfectly certain that people who bought shares at 116 cannot accept 87 for them. Some way out of this difficulty must be found. Either Mr. Cross must abandon his idea of purchase, or must consent to amend his terms. We may just add here that a properly-constituted Water Trust would have no difficulty in recouping the Government in the course of time for the advances they might make. The question is, after all, not a difficult one to solve, and a bold financier would settle it in a moment.

We are happy to see that Dr. Frankland again reports favourably of the condition of the waters sent out by the Metropolitan Companies. He gives every one of them credit for efficient filtration, and notices in some instances the unusual absence of organic impurity. At this season of the year, and with such weather as we have had, it must have cost the Companies some care and attention to keep the water in such a condition as is here reported. In critical times like these, it is well for the Companies to show how efficiently their duties are discharged under somewhat difficult circumstances. Sometimes a great deal is made out of a very little, as when an infinitesimal portion of organic carbon or nitrogen is alleged to be present, and still more when a few living and moving organisms are seen in the deposit from a litre of water, by the aid of a powerful microscope. We ourselves have not the smallest objection to a little organic matter, nor have we any antipathy to living and moving organisms in reasonable quantity. Still we may admit that water must be considered better without such additions, and we hope that when the undertakings pass into the hands of the Trust, we shall hear no more of them.

Since we last noticed one of these reports, a new Registrar-General has been appointed in succession to Major Graham, in the person of Sir Brydges Henniker. The appointment, which is practically a sinecure, appears to have given satisfaction to very few, and is generally regarded as a piece of jobbery. A successor has also been appointed to Dr. Farr, whose state of health is still regarded as precarious. Dr. W. Ogle, who, we understand, succeeds Dr. Farr, is an amiable man, and a good physician; but he has not, so far as we are aware, made health statistics his study, and the absence of Dr. Farr from the office will be seriously felt. The first appointment we have named has given so little satisfaction to the medical profession that they have requested Dr. Lyon Playfair to make it the subject of a question in the House of Commons. Sir Brydges Henniker was the private secretary to Mr. Sclater-Booth, the President of the Local Government Board; and hence, probably, his appointment.

We have before us a nondescript Bill, which it is proposed to promote in the coming session of Parliament. It is entitled the Dagenham and District Farmers (Optional) Sewage Utilization Bill. It is to be put forward by a few gentlemen, who propose to start with a capital of £150,000, and borrowing powers to the extent of one-fourth of this sum, with a view to take sewage from the Metropolitan Board's northern sewage outfall at Crossness, and, by means of extensive works, distribute it to the farmers at Dagenham and the adjacent district, at the rate of 1s. per thousand gallons. We shall not attempt to describe the nature of the works, which are intended to convey the sewage over a large portion of Essex and Herts. Nothing is said in the Bill of any arrangement with the Metropolitan Board of Works. We may, however, take it that the Board will gladly, for the present, give any amount of sewage gratis. Bargains may be made when the Dagenham Company are assured of a success, which, we are sorry to say, we cannot promise them. Their design is excellent, but we can hold out no hopes that, in the time they ask for, they will be able to make a profit, or for many years afterwards. Nevertheless, they should not be discouraged in their efforts to increase the use of sewage for manurial purposes on a tradesmanlike system. Hitherto one cause of the failure of sewage irrigation has been that it was spread over the land whether it was wanted or not. On the system proposed by the Dagenham Company, it will only be turned on to the land as it is required.

GAS BILLS FOR 1880.

(*Continued from p. 54.*)

THERE are only two Bills to be promoted next session to authorize Local Authorities to purchase the undertakings of Gas Companies.

The first we shall notice is the *Hinckley Local Board Bill*, which is promoted by the Local Board to empower them to effect the purchase of the undertaking of the Hinckley Gaslight and Coke Company, Limited. The Company were formed in 1872 with a nominal capital of £20,000, in £10 shares, on which only £7 10s. has been paid. The arrangement which has been made by the Company with the Local Board is the payment of £30,000 for the 2000 partly paid-up shares. This must be a very satisfactory arrangement for the Company. We regret one thing, of course, and that is that the Company, not having statutory powers, have not succeeded in obtaining such terms as they might have secured if they had had an Act of Parliament at their back. In this Bill it is proposed to make provision for extending the gas limits of the Local Board so as to include the parishes of Burbage, Stoke Golding, and Higham-on-the-Hill. The estimated cost to complete the purchase is £30,000; £1000 for the portion of the Company's works at Burbage, &c.; and £4000 for extensions of plant. Power is sought to borrow £40,000, which sum is to be repaid by means of a sinking-fund in sixty years, the usual returns being made to the Local Government Board. The Local Board are to supply fourteen-candle gas, tested by Sugg's No. 1 "London" Argand burner, at a price not to exceed 6s. per thousand feet.

The *Lancaster Corporation Bill* is to confirm an agreement contained in the Company's Act of last session, which continued an agreement made with the Corporation in 1856 for the purchase of the undertaking of the Gas Company. No statement is made in the Bill as to the sum which is to be paid to the Gas Company as a consideration for the transfer. All the Bill tells us is that the Corporation propose to borrow a lump sum of £120,000 for gas and lighting purposes, the latter term including the electric light. This sum is to be repaid, by means of a sinking-fund, within seventy-five years of the time of borrowing; the usual returns being made to the Local Government Board.

It will be remembered that notice was given of a Bill to authorize the Corporation of Monmouth to purchase the undertaking of the Monmouth Gas and Water Company;

but the transaction has dropped through, the Corporation, we presume, having thought better of it.

There are five Bills by which Corporations and other Local Authorities seek further powers for the extension of their gas undertakings, and at the same time ask for power to supply the electric light.

The *Burton-upon-Trent Corporation Bill* is, so far as illuminating purposes are concerned, to enable the Corporation, for the object of experiment, to expend £5000 in supplying the electric light for a period of five years, the money to be repaid in ten years. The joke is that the Corporation ask for power to supply meters for the measurement of electricity, which is also the case in most of the Bills that follow. The usual clauses are inserted for the protection of telegraph wires. The customary returns in relation to sinking-funds are also to be made to the Local Government Board.

The *Denton and Haughton Gas Bill* is to confirm the dissolution of the Dukinfield and Denton Joint Gas Committee, and empower the Denton and Haughton Local Boards to combine for supplying gas to Denton and Haughton. Power is sought to supply the electric light; also to supply heat and motive power by means of electricity. The usual clauses are inserted for the protection of telegraph wires. Powers are asked to supply electric light for a period of ten years, and to expend the sum of £5000, which is to be repaid in ten years; also to borrow a further sum of £25,000 for gas purposes, which will be a more reasonable expenditure.

The *Hull Lighting Bill* is to enable the Corporation to supply the electric light for a period of ten years; and for that purpose to borrow £50,000, which is to be repaid by means of a sinking-fund in the same time, the usual returns to be made to the Local Government Board. Clauses for the protection of telegraph wires are inserted.

The *Oldham Improvement Bill* is, among other things, to grant further powers to the Corporation in respect of their gas and water undertakings, and also to enable them to supply the electric light. The district in which the Corporation may supply gas it is proposed to considerably extend, by including the district of Royston. The Corporation propose further to borrow £5000, in order to furnish the electric light, first of all to their own buildings, and then to the public. The charge to be made is to be fixed by agreement. The usual clauses for the protection of telegraph wires are inserted.

The *Preston Improvement Bill* is, *inter alia*, to empower the Corporation to supply the electric light for a period of five years, and for this purpose to borrow £10,000, which is to be repaid in the course of thirty years.

The last Bill we have to notice in this article is that promoted by the Corporation of the City of London, with or without (we cannot yet tell which) the co-operation of that august body, the Metropolitan Board of Works. The Bill has on several occasions been referred to in our columns, but it may be as well to repeat here that its object is to alter the clauses relating to forfeitures for defects in illuminating power, purity, and pressure in the several Acts of The Gaslight and Coke, Commercial, and South Metropolitan Gas Companies. For the future, if the illuminating power of the gas of any Company be found defective, that Company is to forfeit a sum of 40s. for the first half candle deficiency, and a further sum of from £25 to £100 for the first whole or any subsequent candle. With regard to impurities, the forfeitures are to be fixed on the average of three days testings, and if above the standard prescribed by the Referees, it is to be visited by a fine of £50. Any deficiency of pressure, which is to be estimated by an automatic gauge, will render the Company liable to a fine of £10.

MR. JOSEPH FRANCIS, of the New River Company, was last Tuesday elected an Associate Member of the Institution of Civil Engineers.

WELLINGTON (NEW ZEALAND) WATER-WORKS.—The Corporation of Wellington have recently been applying in England for a loan of £130,000, to provide for the construction of water-works on the Wainui-o-mata, at a distance of about 15 miles from, and the leading of water thence for the supply of the city, the present works having proved inadequate to meet the increasing requirements of the population. The interest on the loan is secured by power to levy a special rate of 3d. in the pound on the rateable property in the city, in order to supplement the available surplus of income at present derived from other sources. The existing water-works, which represent an expenditure of £80,000 (part of the consolidated loan of £200,000), yield a surplus revenue of £5057, after providing for interest and sinking-fund on the outlay, and all maintenance charges. The land and buildings belonging to the Corporation are valued at £558,200. Tenders were asked for the loan, which is to bear interest at 6 per cent. per annum, the minimum price fixed being £2 per cent. premium. Last Friday, the tenders were opened at the London office of the Bank of New Zealand. The total amount tendered for was £492,600, at prices ranging from the minimum to £110. Tenders at and above £103 16s. receive allotments in full, and those at £103 15s. 6d. about 65 per cent. of the amount applied for.

URBAN WATER SUPPLY.

IN an article under this head in a former number of the JOURNAL (*ante*, p. 12) we drew attention to the want of completeness in many respects in the accounts of the water supply of towns in the drainage area of the Thames, as given in a Blue-book issued about two months ago. We confined our attention then to the sources of supply, pointing out the position of the various towns in relation to the main stream or its tributaries; but there are several other points concerning which inquiries have been made. Among these are the conditions of supply, whether constant or intermittent, the quantity supplied per head of the population, the cost of works, and the charge to the consumer. There is also a column devoted to the authority under which the works are carried on, and another is given to the need and prospect of improvement.

Still limiting our inquiry to the Thames drainage area, and excluding the various towns round London supplied by the Metropolitan Water Companies, whether entirely or mainly, we find that in the whole of the Upper and Middle Thames drainage areas there are only ten towns (Oxford, Reading, Chipping Norton, Aldershot, Watford, Harrow, Uxbridge, Alton, Guildford, and Epsom) the supply of which is provided by the town authorities under local or general Acts. In all these the supply is constant, or nearly so. In eight towns there is a supply provided by Companies. In one of them (Windsor) it is intermittent; in five (Eton, Slough, Banbury, Wantage, and Aylesbury) it is constant; and in Maidenhead and Swindon the return does not state whether it is constant or intermittent. There are eight towns, all of some magnitude (Abingdon, Wallingford, Henley, Staines, Cirencester, Witney, Bicester, and Thame), of which it is only recorded that their supply is drawn from wells. These are in most cases surface wells, and they are not connected with special arrangements for supply either from Companies or Local Sanitary Authorities. There are upwards of twenty towns within the Metropolitan limits supplied by the Metropolitan Water Companies.

Of the towns on the Thames above Teddington there are 25 whose population amounts to or exceeds a thousand, but of these the particulars of the quantity and cost of the water supplied are only given as regards four—viz., Oxford, Reading, and Windsor, the latter town also supplying Eton. At Oxford there is a constant supply of 50 gallons per head, which is certainly in excess of the requirements. At Reading it amounts to 34 gallons, and at Windsor and Eton, which are supplied by the same Company, the quantity consumed per head per day is said to be 38 gallons at Windsor and 30 gallons at Eton. In all cases the waste is remarkable as compared with that of towns having constant supply under proper supervision. The cost of the works at Oxford is not known. The total amount of the water-rates, however, is stated at £6400, and as the average daily consumption is 1,750,000 gallons, the price of the water is a trifle less than 2½d. per thousand gallons. At Reading the capital cost of the permanent works is stated to have been £82,500, or 51s. per head of population. The rates, taken on an average of five years, show that the price has been about 4·9d. per thousand gallons. At Windsor and Eton the capital cost is stated at £50,000, or about 63s. 5d. per head, and the cost per thousand gallons to the customers was 4·7d. The Company therefore supply the inhabitants of Windsor and Eton at a somewhat lower price than that charged by the Corporation of Reading, and both charge nearly double the price paid for water at Oxford, where, however, the waste is very much greater.

Below Twickenham, as far as Erith, the towns on the river are, with very few exceptions (Richmond being the only one referred to in the return), within the range of the Metropolitan Water Companies. At Richmond, supplied from deep wells, the daily quantity averages 475,000 gallons, being more than 30 gallons per head. The cost of the works has been about 53s. per head of population, and the price paid by the ratepayers is 3·46d. per thousand gallons. Gravesend is the only other town on the river about which details are given. The daily supply there is stated to average little more than 7½ gallons. No information is given as to the charge made for the water.

When we turn to the towns within the Thames drainage area, but not on the river, it is impossible not to be struck with the extreme paucity of information given in the Blue-book. At Chipping Norton, in the Evenlode sub-drainage, although arrangements were in progress in 1875, no return is made in 1879. At Banbury, on the Cherwell, there is a constant supply of 22 gallons per head from a Company, but no information is given as to cost, either as to the capital of the Company or the charge to the customers. At Wantage,

on the Ock, there is a private Water Company, obtaining water from wells, not artesian, and springs which at some seasons run freely, but are occasionally dry. The water is charged for at the rate of 1s. to 1s. 6d. per thousand gallons. Aldershot is described as badly supplied with hard water from land springs, a small quantity being stored, but an artesian well in progress. A constant quantity, equivalent to less than 5 gallons a head per diem, is stated as all the available supply to be depended upon, and no information whatever is vouchsafed as to the cost of work, or the charge to the consumer.

In the sub-drainage area of the Colne we have some facts with regard to four towns out of the fourteen it contains. At Watford the supply is from artesian wells in the chalk, and as much as 40 gallons per head per day are raised by pumping, the supply being constant for fifteen hours per day. The works were constructed under the general Acts, at a cost of 23s. 4d. per head, and the water is supplied to the inhabitants at the rate of 2s. 3d. per thousand gallons. The figures, however, do not carry out this statement, as we are informed that the average annual cost for maintaining the works is £700, and the annual payment for principal and interest on money borrowed is £745, whereas the amount of water-rates in the last financial year was only £1040. At St. Albans there is a Company raising from deep wells in the chalk an average of 12 gallons per head of the population; but only supplying 9 gallons per head. Nothing is stated as to cost or charge. Harrow gives a constant supply of 34 gallons per day from chalk wells, the capital cost of works having been about 40s. per head, and the charge to customers 7·74d. per thousand gallons. Uxbridge is also supplied from wells in the chalk, the quantity used and wasted being nearly 27 gallons per head per day. The cost of the works was £3 6s. 8d. per head, and the charge is 3·74d. per thousand gallons.

In the sub-drainage area of the Wey we learn some particulars about Alton and Guildford, but none of Farnham, Godalming, Woking, or Weybridge. Alton is supplied with less than 6 gallons per day per head of population, from a deep well in the chalk, yielding, or capable of yielding, by estimation nearly 20 gallons per head. The cost of works has been about 35s. per head, but rates had not been levied at the date of the return. Guildford has 21 gallons per head per day, from a well connected with reservoirs. The supply is constant for thirteen hours, the cost of works being little more than 20s. per head, and the charge 5·6d. per thousand gallons.

Of the Mole sub-drainage area, with its seven considerable towns, there is only information as to quantity and cost as regards Reigate, which is partly supplied from deep wells in the greensand, and partly from Caterham, where the water comes from the chalk. The quantity supplied is not stated. The Companies supplying Reigate also supply some smaller towns, and no clear account of the cost of the water to their customers is given.

Epsom is in the Hog's Mill drainage area. The consumption there per head is 28 gallons per day, and the supply is constant for twelve hours. The cost of works is about £2 per head, and the charge 5d. per thousand gallons.

We come next to the towns in the drainage areas below London. In the Wandle sub-drainage, Croydon is the only town concerning which any sufficient information is given. There the deep wells, sunk at a cost of little less than £100,000, including distributing charge (about 33s. 5d. per head of the population), supply nearly 50 gallons per head per day, at a cost of 2·58d. per thousand gallons. The supply is constant, and the waste considerable; but the town is wealthy, and the borrowed capital is being rapidly paid off.

In the Lea drainage area we find artesian wells at Dunstable raising and delivering on an average a constant supply of 6 gallons per day per head. This is described as being "abundant," and it is said "no improvement is necessary." The capital cost is stated to have been only £650, and the charge is 8·9d. per thousand gallons, which will quickly be reduced to one-third if the statement of cost is correct. Hertford has an intermittent supply of 31 gallons per head, at a charge of about 2d. per thousand gallons; but the works are about to be enlarged. Ware has a constant supply of 34 gallons per head, at a charge of a little less than 2d. Bishop's Stortford has only 16 gallons per head, but the charge is 4·46d. per thousand gallons. Enfield has nearly 19 gallons per head, at a charge which, as stated, appears to be equivalent to almost 10d. per thousand gallons.* Tottenham has 26 gallons per head per day, and the charge is 2·9d. per thousand gallons. All these towns in the Lea drainage area are supplied from chalk wells.

We have thought it desirable to give the substance of the information in the Blue-book before us, so far as regards the Thames drainage area. Our readers will perceive the limited scale on which it can be regarded as satisfactory. In only three cases have successful attempts to obtain information been recorded as to the dealings of Companies with their customers, and only in two of these cases is the charge per thousand gallons deducible. Out of a total of nearly a hundred towns, exclusive of those taking supply from the Metropolitan Water Companies, the facts and details are only given of one-fourth. On the whole, it may be remarked that the waste is generally very great, the charge for water very low, and the cost of works very small in proportion to the population and supply. In the great majority of the towns here referred to, the water is extremely hard, being pumped from the chalk, but the quality is good.

* The rate is said to be 1s. in the pound on a rental of £90,362, which amounts to £4518 2s. for water-rate, and is equivalent to nearly 10d. per thousand gallons. The cost of maintenance and repayment of principal is, however, stated at only £2100, which is 4·6d. per thousand gallons.

Communicated Article.

THE CORROSION OF IRON.

By Mr. WILLIAM FOSTER, M.A. (Cantab.), F.C.S., &c.,
Professor of Chemistry at the Middlesex Hospital.

FOURTH ARTICLE.

I now come to the consideration of the subject of corrosion of iron gasholders, and I would refer my readers to Mr. Monk's paper, read at the last meeting of the British Association of Gas Managers, and the discussion thereon, published in the JOURNAL OF GAS LIGHTING for July 22, 1879, p. 144.

The duration of an iron gasholder is much shorter in a hot climate than that of a similar one at home. The cause of this difference is primarily due to the higher temperature, and therefore augmented corroding action which obtains in the former case. The experience of different engineers, as given in the paper and discussion to which I have referred, is not by any means uniform in all particulars. For instance, in one case the crown and upper portions of the holder were those in which the corroding action was most exerted. In another instance the greatest corrosion was found to take place in those parts which were immersed in the water of the tank. The opinions expressed as to the cause of these results were also numerous. The bad quality of the iron, the presence of free oxygen in the gas stored in the holder, the presence of ammonia and of sulphuretted hydrogen as impurities, the use of brackish water for filling the tank, were severally advanced as causes in special cases. Each is undoubtedly an important factor in the change; but, from a careful consideration of the whole subject, I am of opinion that no one of these agencies is sufficient to account for all that is known in connection with the matter.

And, firstly, with reference to the corrosion of the upper parts of the interior of the holder, usually surrounded with an atmosphere of coal gas. The corrosion of the outside of a holder, whether at home or abroad, is a simple and easily understood process. That of the interior is not by any means so obvious. I believe that I am expressing the general experience of engineers at home when I say that there is little or no corrosion of the interior of the upper part of a gasholder in its ordinary use. In such cases the coal gas contains, at the most, but small quantities of impurities, and these are not likely to be seriously prejudicial if the surface of the iron be coated periodically with tar in the ordinary way. The atmosphere of coal gas in the interior of the holder does not contain more than a very small percentage of free oxygen, and, therefore, oxidation can only proceed slowly at ordinary temperatures. That there must always be a small quantity of free oxygen in coal gas is apparent from a consideration of the methods of charging the retorts. The coal and a quantity of atmospheric air are introduced at a comparatively low temperature. This air is sealed up along with the coal on closing the lid of the retort, and is almost immediately very considerably raised in temperature. The rapid increase of temperature of the air thus confined is attended with an increase of volume, and a portion of the air passes over into the hydraulic main. The bulk of the oxygen shut up in the retort is, of course, consumed by the hydrogen of the coal, or gas, forming steam; but still there must be a small and intermittent supply of atmospheric oxygen to the contents of the gasholder. Further, in consequence of the solubility of oxygen in water, there is a feeble, but regular, supply of this element to the interior of the holder through the medium of the water in which it is immersed. This small quantity of free oxygen in coal gas would be unimportant in a temperate climate were the holder not continually rising and falling in the water. As a matter of fact, certain parts of the iron are oftener in the condition of being alternately "wet and dry" than others, and these are the parts in which the corrosion is the greatest. This alternately wet and dry condition exerts a deleterious action on the paint or other medium employed for preserving the surface of the iron, inasmuch as it tends to detach it from the latter at certain spots. These become centres of oxidation, the areas of which gradually increase, removing portions of paint in the course of their growth.

There is no *essential* component of purified coal gas, so far as I know, which is calculated to corrode iron. Sulphuretted hydrogen exerts a very deleterious action, but this impurity is absent in the gas supplied by the London Companies. I can recall two instances

only of the presence of traces of this gas during a daily experience of more than two years as a Gas Examiner to the Metropolitan Board of Works. The removal of sulphuretted hydrogen by means of ferric oxide is so simple and complete a process, even when conducted at unusually high atmospheric temperatures, that there can be no excuse for the continual presence of even small quantities of the impurity. Could it be shown that coal gas manufactured at any given works in a hot climate is allowed to be contaminated regularly with sulphuretted hydrogen, it would be quite safe to predict rapid corrosion of the iron holder used for storing it. The sulphuretted hydrogen, aided by the small quantity of free oxygen in the gas and the moisture, the latter of which must inevitably trickle down the sides of the holder at nightfall, would soon exercise a marked corrosive action. I have not any evidence as to the freedom, or otherwise, of a given gas supply from sulphuretted hydrogen, such gas having exercised a marked corrosive action on the iron holders; but, at the same time, I strongly suspect that this impurity is an important factor in cases of excessive corrosion. Gas managers thus situated cannot be too alive to the importance of keeping their gas supply continuously pure, not only on the score of public health and convenience, but also on that of personal reputation for economical working of their plant.

I am unable to find any evidence respecting the influence exerted by ammonia on iron when the former occurs as an impurity in coal gas. The case is not by any means analogous to that of exposing iron to dry ammonia gas or its solution. It is said that a small quantity of ammonia in air does not exert any action on iron. But here I wish to remark that the evidence on this point is extremely meagre. I have just now quoted from Dr. Percy, who in turn quotes from Bonsdorff (*Répertoire de Chimie*), and Bonsdorff again takes his information from the *Annalen der Chemie*. A given strength of solution of ammonia gas in water is said to act as a preservative of iron, like solutions of the other alkalies and alkaline earths already noticed. Now, assuming that ammonia gas is generally present in small quantity as an impurity, and that the quantity present is greater in gas manufactured in a hot climate than in a temperate one, what influence is it likely to exert on iron? From the evidence before us we may fairly consider that, *in itself*, its action will be neutral, or perhaps preservative. What substance or substances, then, are likely to impart to it a corroding influence? The only one, so far as I can see, is sulphuretted hydrogen. The two compounds are well known to be capable of entering into chemical combination, producing sulphide of ammonium, which is a volatile and unstable salt. The vapour of this substance, acting on the iron in the presence of moisture and small quantities of free oxygen, would effect rapid corrosion at high temperatures.

With reference to the amount of ammonia in coal gas. The London Companies furnish their consumers with a product containing but mere traces of this impurity. It requires no argument in the present case to show how desirable it is, from a commercial point of view, to recover all the ammonia manufactured in the retorts. Speaking generally, the means adopted are those of simply washing the crude gas with water in such a way that it shall finally emerge from what is, approximately, pure water. In a temperate climate the process can be worked much more economically and successfully than in a hot one. The solubility of ammonia gas in water is much greater at ordinary than at high temperatures, and, therefore, in order to remove it as perfectly in a hot climate as at home, necessitates the use of much larger volumes of water. No doubt it is found inconvenient in practice to do this, and, therefore, it is extremely likely that gas manufactured in a hot climate, and washed with water *only*, contains more than mere traces of ammonia. The difficulty could be easily overcome in such cases by washing the gas, after final purification, with a solution of a cheap salt capable of fixing the ammonia. A solution of green vitriol (ferrous sulphate) would effect the desired purpose, and furnish a liquor from which the ammonia could be eventually recovered as easily as it is from ordinary ammoniacal gas liquor.

An ingenious hypothesis has been advanced to account for these cases of excessive corrosion. It is to the effect that moisture raised by the sun's rays, and diffused through the gas, would re-act on the sulphur compounds (presumably bisulphide of carbon, CS_2) causing chemical decomposition, the hydrogen of the water being liberated in the gaseous state, whilst the sulphur and oxygen combining would furnish an acid product. From what is known concerning such decompositions, it is extremely improbable that this would occur under the circumstances. Although the sun's rays are powerfully exerted outside the holder, and raise its temperature, still their influence on the contents is purely of a thermal or heating character. Ordinary solar rays exert their influence in three ways—firstly, they have a thermal or heating effect; secondly, they render luminous most bodies on which they may fall; and thirdly, they are capable of bringing about certain chemical actions. The three kinds of rays, therefore, which make up solar light are technically known as thermal (heating), luminous, and actinic (chemical). All these are arrested when they fall on the iron holder, the thermal rays in particular being in a large measure absorbed, and in that way they raise the temperature of the holder. This in turn radiates heat rays from its inner surface, and brings about elevation of temperature of the gas. The luminous and chemical rays, however, are never radiated from the inner surface. The former would only be possible were the holder raised up to a red heat, and the latter would only appear when the iron had been further considerably raised in temperature. The case, therefore, is resolved into the question of what will occur when the sulphur compounds in coal gas are moderately heated in the presence of vapour of water. But these conditions obtain in the manufacture of coal gas, only in a more exalted degree, and therefore I think that the hypothesis is untenable. Further, from what we know respecting the chemical affinities of hydrogen, sulphur, and oxygen, as exemplified by a solution of sulphuretted hydrogen in water exposed to atmospheric oxygen—in which case the hydrogen is oxidized and the sulphur is deposited as such—we should still expect that the superior affinities of hydrogen and oxygen would be maintained, although the sulphur might be present in the form of vapour of bisulphide of carbon.

And, secondly, with reference to the corrosion of the parts of the holder immersed in brackish water. In my second article the general principles involved in a case of this kind were briefly discussed. The wrought iron contains fine particles of crystalline graphite disseminated throughout its mass, and the whole is surrounded by a weak exciting liquid. Such a case is very like that of commercial zinc placed in dilute sulphuric acid. Chemical action at once commences, attended with the evolution of hydrogen gas. *Pure* zinc is practically unacted on by dilute sulphuric acid. Commercial zinc contains small quantities of other metals as well as free carbon. These bodies, foreign to the zinc, and differing from it in their chemical characters, form local galvanic couples, in which the zinc is the more negative of the two, and is therefore consumed. The particles of graphite in wrought iron are positive relatively to the mass of the iron; and, therefore, when a sample of wrought iron is immersed in brackish water, there is a manifestation of local action similar in a modified degree to that which obtains when commercial zinc is placed in very dilute sulphuric acid.

But "local action" is not the only difficulty which the gas engineer has to cope with. There may be a general action in such instances, due to the coupling together of dissimilar metals, or pieces of a metal in dissimilar conditions. It is not probable that an engineer would fasten together iron and copper, and then employ the combination in brackish water. One trial would be sufficient to prevent him from repeating the experiment. Now, the binding together of wrought and cast iron in certain structures is extremely objectionable, if the whole is situated so as to be affected by saline solutions. Yet this arrangement has been adopted in at least one of the cases where there has been notorious corrosion of the wrought iron. The wrought iron holder in this instance was immersed in brackish water, contained in a cast-iron tank, and it is fair to infer, from the disastrous results which followed, that the wrought and cast iron were intimately connected through the medium of the vertical pillars of the holder. Such being the case, the arrangement was that of a huge galvanic cell, in which the wrought iron was negative to the cast iron. Each was, no doubt, the seat of some local action, and particularly the wrought iron. But, in addition to this, the latter was affected by a *general* action set up in consequence of the metal, iron, in two dissimilar states being coupled together in a weak exciting liquid.

Cases of excessive corrosion, such as we have now considered, have been attributed to the employment of iron of bad quality. I fear that such statements have been made without due consideration of the circumstances. Wrought iron is obtained from cast iron by a succession of chemical and physical processes, the chief aim of which is to burn out *nearly* all the carbon, and as much of the impurities as possible. If this burning out of the carbon is not sufficiently prolonged, the resulting iron contains more carbon than good wrought iron should contain, and less than good cast iron; in fact, the product would be technically called *bad* wrought iron. As the result of experimental evidence, we know that cast iron resists corroding influences better than wrought iron, and therefore we are justified in assuming that, other things being equal, the more nearly a sample of wrought iron approximates to that of cast iron, and particularly of white cast iron, the better will it resist the action of agencies tending to produce corrosion. In short, the worse the iron (using the word "bad" in the popular sense) the better is it calculated to resist these influences. I have heard it cynically remarked that the mere fact of goods being British productions is no longer a guarantee of superior excellence abroad. I do not suppose that the constructors of gasholders are so short-sighted as to merit that sweeping assertion.

The subject of paints and similar matters will next claim my consideration.

THE PURCHASE OF THE CARDIFF WATER-WORKS BY THE CORPORATION.—At the meeting of the Cardiff Town Council on Monday, the 12th inst.—the Mayor (Mr. J. M'Connochie) in the chair—the Water-Works Committee presented a report as to the water-works purchase, which was completed on the 24th of December last. The report stated that of the sum of £309,019, the total amount paid to the Water Company, one quarter's gross revenue—say about £4300—was due to the Corporation, which, with the expenditure on account of capital, £1627 2s. 9d., would reduce the amount to about £304,800. According to the terms of the agreement of purchase, the Corporation were to take over the debenture debt of the Company, amounting to £20,450. Towards the deficit the Committee had accepted various loans, amounting to £29,278 1s., to be paid on or before Jan. 7, 1880, and the sum of £25,778 1s. had been paid in respect of this. The first payment on account of the loan was made on Nov. 5, 1879, and on Dec. 17, 1879, the Committee determined to close the list of applications, so that in 42 days they had negotiated the whole of the loan required—viz., £310,523 10s. 1d.—at interest after the rate of 4 per cent. per annum. With regard to commission, the Committee had obtained the loan at the following rates:—£60,000 at 1 per cent.; £93,500 at 10s. per cent.; £12,200 at 5s. per cent.; and £144,823 10s. 1d. without any commission—total, £310,523 10s. 1d. The Committee having completed the transfer of the undertaking, felt that their duties were nearly at an end so far as regarded the purchase, and they had only to ascertain the cost of obtaining the Cardiff Corporation Act, 1879, and other incidental expenses, in order that the Corporation might be in a position to know the exact cost of acquiring the water-works. The report was, on motion, adopted after a short discussion.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE HYDRAULIC MAIN.

Sir,—I have read with much pleasure Mr. R. H. Patterson's communicated article on the Hydraulic Main, which appeared in your issue of the 6th inst. This pleasure was alloyed, however, to a considerable extent, by having to disagree with him in his remarks anent the pulsation of the gas, induced by the seal in the hydraulic.

Mr. Patterson admits that the seal will have the effect of allowing the gas to escape intermittently, and that the pressure will be variable inside the retort, yet withal it seems to him that the mere manner in which the back-pressure works (by producing pulsation in the gas) is of little effect; but he says he goes further, for although admitting that the intermittent escape of the gases from the retort causes pulsation beyond the seal, he alleges that it has no reflex action to result in pulsation inside the retort. To illustrate his reason for arriving at such a conclusion, he says: "Take a cistern, or any open vessel, and allow the water to rush out by alternately opening or shutting the outlet. You will see plainly that, beyond the outlet of the cistern, the water moves along the pipe or channel in rushes or pulsations; but you will not find such pulsations in the mass of water within the cistern. Each time the outlet is opened there will be a movement of water towards the oublet, but there is no back-flow. The water that has issued is gone, and the water which has been moving towards the outlet simply fills the place of the water which has escaped, and then comes to rest."

Had Mr. Patterson actually made this experiment more particularly, employing a long, retort-shaped cistern, he would have found that his inferences were not borne out by the results, for he would have seen that, on opening the outlet, the whole mass of water in the cistern would have been set in motion towards the opening; that on suddenly closing the outlet, the motion of the water would not, as he supposes, be suddenly arrested, but the accumulated motion would be expended in lifting the water in a sort of tidal wave against the outlet end. This wave would in turn subside and drive back the water, which would pass to the opposite end; and if the outlet were opened and closed to synchronize with this tidal wave, it would, provided the supply of water were kept up, grow higher and higher.

Further, to make conditions alike, Mr. Patterson would require to attach a pipe to his cistern, as an equivalent for the stand-pipe from the retort, and he would require to place his valve on the further end of this pipe, and attach an air-vessel as a substitute for the hydraulic seal. Under such modified conditions, he would be enabled to obtain still more conclusive evidence that the column of water when set in motion tends to keep in motion. On opening the valve, the column of water contained in the pipe, as well as the water in the trough-shaped cistern, would flow forward, and on again shutting the valve the forward motion of the water would expend itself in compressing the air in the air-vessel; but the compressed air, in again expanding, would drive back the water with great force into the cistern. The common hydraulic ram furnishes a good illustration of the application of this force, when the inertia of a column of water is employed to raise a quantity of itself to considerable heights.

The analogy, however, in this experiment, to gas in a retort is not quite perfect, water being almost non-compressible, whereas the gases in the retort are highly elastic; and this very elasticity of the gases tends if anything to increase the pulsations, from the freedom of the motion of its molecules over each other. This, I think, was pretty clearly shown in the experiments which I had the honour of showing before the North British Association of Gas Managers at Stirling, on July 13, 1877.

Mr. Patterson further says I hold that the carbon deposits are almost entirely due to these pulsations; or, in other words, not to the *back-pressure*, but to the manner in which it operates; and alleges that I have neglected to take notice of the fact that carbon is deposited without any back-pressure at all, owing to the mere fact that a portion of the gas must come into contact with the sides of the retort, whereby a part of the constituent carbon tends to be solidified and deposited; secondly, that the longer this contact endures, the greater will be the deposit, always supposing that the heat of the retort and the smoothness or roughness of the inner surface is the same; and as back-pressure tends to retain the gas in the retort, that, consequently, the greater the back-pressure, the greater will be the deposit of carbon.

If Mr. Patterson will refer to the paper of mine to which I have just alluded, he will see that I hold that heat is the prime cause of the deposition of carbon; that carbon is necessarily deposited before the volatile constituents of coal can be arranged to form permanent gas; that the higher the temperature the greater will be the amount deposited; that it depends upon how the heat is applied to bring about the decomposition of the volatile constituents of the coal when and where the carbon is deposited, and in what condition or state; that I hold that surface contact is the principal medium through which heat is transmitted to the volatile constituents of the coal to tear asunder and re-arrange them into permanent gas; that carbon is necessarily deposited on such surfaces as bring about decomposition; that any condition which will bring about an extra amount of contact between the volatile constituents of coal and the heated surface, will also bring about an extra amount of deposited carbon; that the conditions of gas-producing plant bringing about such extra amount of contact are (1) the state of the internal surface of the retort itself, rough or smooth; (2) the compression of the volatile constituents of the coal whilst undergoing decomposition; (3) transpiration of the volatile products of the coal through the walls of the retort, due to the greater or less back-pressure over that of the surrounding atmosphere, and the more or less porosity of the retort-walls; and (4) the pulsation of the volatile products inside the retort, already referred to. He will also see that I hold that the mere compression of the gases I consider to have a small influence in affecting carbon deposit, and much smaller than that induced by the pulsations of the volatile constituents in the retort; but, at the same time, I wish him to observe that I do not include transpiration due to *back-pressure*, as he appears to have understood me to do. I would also ask Mr. Patterson to refer to a paper, the result of further investigation of the subject, which I laid before the West of Scotland Association of Gas Managers, at their meeting at Kilmarnock on the 26th of September, 1878, and which was published in your columns immediately afterwards. He will there see what I consider to be a fifth condition influencing the amount of carbon deposit, and which I believe to be a more potent one than any other—I refer to the diffusion of gases and vapours through porous septa. He will also observe a sixth, and I believe an entirely new view of how heat acts upon the volatile constituents of coal in the empty space over the coal in the retort—viz., by the absorption of radiant heat, the carbon in such cases being deposited as soot, and carried forward with the current of gas.

There are some other points in Mr. Patterson's most interesting article which I would have liked to touch upon; but the time at my disposal for such subjects is now limited. I may, however, on a future occasion have the pleasure of recurring to the subject.

W. Young.

Clippens Oil-Works, Jan. 14, 1880.

GAS-ENGINES.

Sir,—I have just learned that a letter of mine, on "Gas-Engines," appeared in the last number of *Engineering*. As the subject is interesting to Gas Companies, and is treated in a novel way, perhaps you would find room for it in the Journal. It is a subject to which I may return, taking up the economical part of it.

Denny Lane.

Cork Gas Consumers Company, Jan. 13, 1880.

To the Editor of *Engineering*.

Sir,—In all industries which require a small amount of motive power, the use of the gas-engine is extending day by day. The fact that it is ready at a moment's notice without the delay caused by lighting fires or getting up steam, or the expense of keeping up the pressure during intervals of work, the small amount of attendance which it requires, and its immunity from danger of explosion, are some of the reasons that specially recommend it. On the other hand, it has not been long enough in use to enable practical men to decide on its probable durability, and the high temperature at which it works makes considerable doubt be entertained upon this point. In some kinds of engine the slide-valve especially seems to undergo rapid deterioration. In some of the latter patterns, however, it is said that the valve is maintained at so low a temperature that no apprehension need be entertained upon this point. Again, up to the present the price charged for gas-engines has been rather high, but competition will doubtless remedy this objection, and, indeed, of late some engines which have not as yet fully come into the market are advertised at prices remarkably low. If these engines are good they will be sold largely, not only for manufacturing but domestic purposes, and the pumping of water, the cleaning of cutlery and plate, the polishing of boots and shoes, &c., will ere long, not only in hotels, but even in private houses, be performed by this cheap and handy "slave of the lamp."

My object in writing to you at present is to call the attention of your readers to the relative efficiency of the heat employed in the gas-engine as compared with the steam-engine.

All your readers are, of course, aware of the meaning of the mechanical equivalent of heat, or the quantity of dynamic energy that is equal to a thermal unit. I will employ the English mechanical unit—viz., a foot-pound, or the quantity of work employed in raising 1 lb. 1 foot vertically, and the English thermal unit, or the quantity of heat which is sufficient to raise 1 lb. of water 1° Fahr. I will call the first foot-pounds, and the second θ.

The mechanical equivalent of heat, as experimentally determined by Dr. Joule, and theoretically calculated by others, is $1\ \theta = 772$ foot-pounds, that is to say, that if all the heat in 1 θ unit were converted into work, this work would be equal to 772 foot-pounds; or 772 foot-pounds, if converted into heat, will produce 1 θ.

The large unit employed by engineers—viz., the horse power, is 33,000 foot-pounds, and therefore the thermal equivalent of the amount of work is $\frac{33{,}000 \times 60}{772} = 2563\ \theta$, or 2563 heat units are converted in producing 1-horse power.

It is calculated that good coal by its combustion generates 14,000 θ. If all the heat could be converted into work, it would thus require only $\frac{2{,}563}{14{,}000} = 0{\cdot}081$ lb., or about 1-12th of a pound of coal to maintain 1-horse power for an hour.

We know that the best compound condensing engines use 2 lbs. of coal, a good ordinary condensing engine uses 5 lbs., and small high-pressure engines from 4 lbs. to 10 lbs., and even more, per hour. It must be remembered that when the work is interrupted at night and at meal times, a considerable quantity of fuel is used in getting up and maintaining steam.

The economical result may be summed up as follows:—Engines using the quantities of coal enumerated below, convert into work the following percentage of the total heat of combustion:—

Engines using	2 lbs.	per high pressure	convert	8·0 per cent.
"	3	"	"	5·3 "
"	4	"	"	4·0 "
"	5	"	"	3·2 "
"	6	"	"	2·6 "
"	7	"	"	2·3 "
"	8	"	"	2·0 "
"	9	"	"	1·8 "
"	10	"	"	1·6 "

Let us now take the use of the gas-engine. I will give four examples, taking the maker's statement as to the consumption of gas:—

I.	. . . . .	20	cubic feet per hour.
II.	. . . . .	15	" "
III.	Not condensing . . .	15	" "
IV.	Condensing	10	cubic feet, and 12 gallons of water.

There is considerable variation in the quality of coal gas. The higher the illuminating power, the higher also the heating power; but the latter quality increases in a less ratio than the former. For example, cannel gas of 26 candles is, for supplying light, 75 per cent. better than ordinary 15-candle coal gas, but some recent experiments show it only about 23 per cent. better for heating purposes.

Cannel gas of 33 candles, although 120 per cent. better for lighting than the first, is only about 50 per cent. better for heating.

In order to fix on some standard, I will take ordinary coal gas of, say, 16-candle power, such as is supplied in London. The heating power of coal gas has been variously estimated as under:—

M. Morin, 696 θ; Dr. Letheby, 650 θ; Mr. Evans, 650 θ; Mr. Goddard, 652 θ; Mr. A. G. V. Harcourt, 756 θ.

I am inclined to think that the latter estimate is nearer the average than the others. I will, however, assume 700 θ, being the mean between

the extremes given above. We, therefore, see that the gas-engines mentioned above should develop by the combustion of gas—

No. I. . . . . (20 × 700) . . . = 14,000 θ.
Nos. II. and III. . . . (15 × 700) . . . = 10,500 θ.
No. IV. . . . . (10 × 700) . . . = 7,000 θ.

If all the heat of combustion of 1 cubic foot of gas were converted into work, 1-horse power would require only $\frac{700}{2560}$ = 3·66 cubic feet per hour.

If we do as before, and divide 2563 θ by each of these numbers, we get the following results:—

No. 1. $\frac{2,563}{14,000}$ . . . . . = ·183
Nos. II. and III. . . . . = ·244
No. IV. . . . . = ·366

Or, in other words, the percentage of the heat of combustion converted into work is as follows:—

	Per Cent.
No. I. gas-engine converts	18·3
Nos. II. and III. gas-engines convert	24·4
No. IV. gas-engine converts	36·6

If we contrast these percentages with those already given for the steam-engine, we find that No. I. converts into useful effect twice as much of the heat as the best steam-engine, six times as much as a good condensing engine, and eleven times as much as small high-pressure engines commonly employ. No. IV. is said to turn into useful effect four, twelve, and twenty-three times as much heat respectively as the several classes of steam-engines referred to.

These results seem remarkable for a machine which I may say, as compared with the steam-engine, is almost in its infancy, and it is almost possible that some special qualities of gas will hereafter be manufactured, at a low cost, for the production of heat and motive power. If such be the case the province of the gas-engine will be far extended.

I will not at present go into the question of cost, but a friend of mine has remarked that a very important social change may arise from perfecting the gas-engine. If the production of motive power on a *small* scale can be made economical, the small manufacturer may be able to compete with the great millowner, and the productions of the country may to a great extent come from men and women and children associated in families, and not from "hands" crowded together in great factories.

Cork, Jan. 5, 1880. DENNY LANE.

SAFETY LAMPS IN GAS-WORKS.

SIR,—I have your JOURNAL of Jan. 6, and have read the letter of Mr. Mann with great interest; as also that of Mr. Key. I give you my experience—viz.: Last year, when we were in full winter work, I was called up at 12.30, my foreman reporting that there was a great escape of gas in the purifier-house. I at once went down with one of Armstrong's lamps, and, without hesitation, entered the house. We found a syphon-pipe was blowing; and, to enable my men to put in more water, I held my lamp over the faulty syphon-tank. The lamp was directly over the free flow of gas, and was extinguished four times; but we had no explosion in the house. One night this winter, too, we had a very great escape of gas in the condenser-house. Two of these safety lamps were in the house on this occasion, and we had no explosion. These are facts.

I may mention that, before giving the lamps to my men, I tested their efficiency by passing a full stream of gas into them; and, in every case, the light was extinguished.

Like everything about a gas-works, the lamps should be examined daily, kept perfectly clean, and in good repair.

Porto, Jan. 14, 1880. LAYARD JONES.

FROZEN LAMP SERVICES.

SIR,—In answer to your correspondents on this subject, I never knew of any inconvenience caused by frozen lamp or other services when properly laid—that is, with sufficient fall to the main-pipe. Of course, if so laid as to hold condensed or other water which expands on becoming frozen, they must be troublesome. In such cases I would rather lift and re-lay them properly than incur the expense of spirits.

Sligo, Jan. 17, 1880. T. GILCRIEST.

THE USE OF STEAM IN THE HYDRAULIC MAIN.

SIR,—About two years ago (having then but recently entered my present works), I found that there was a great deal of thick pitchy tar in our hydraulic main, so much, in fact, as to almost seal the dip-pipes. As the dark season was upon us, and we could not then well spare the time to clean the main, I introduced a small steam-pipe into it, below the seal, in the hope of (with steam) softening the pitchy tar sufficiently to cause at least some of it to run off, thus temporarily relieving the dip-pipes; intending in the spring to clean the main properly. The expedient was entirely successful, but that is not the subject of this communication.

Soon after turning on the steam, I noticed the flame of our jet photometer—which is kept burning constantly—got very high and smoky; and, finally, I could not, with that instrument, approximate the candle power of the gas at all. A short time after turning off the steam in the hydraulic main, the flame of the photometer resumed its normal appearance; and on turning on the steam again became as high as before. I will not presume to advance a reason for all this, because the matteris so simple, and your scientific readers can easily account for it to their own satisfaction. But to continue with my experience.

From the time the foregoing was observed, I have kept the steam in the main, the result being an increase of the candle power of our gas of from one to three candles, the average for the past year being two candles. We use steam at 30 lbs. pressure, the amount being what a ¼-inch globe valve one-sixth open will let through. The end of the steam-pipe is 3 inches below the seal, and just at the outlet of the hydraulic main. There is a photometer in our principal office, about a mile from the works, and daily observations are taken there as well as at the works. Comparing the observations recorded at these two points, the quality of the gas corresponds, and does not show any greater difference when using the steam as described, or when not using it.

These are the plain facts; and, having no patent, nor intention to patent what accident brought to my observation, I give them to you, and hope that this letter may prove of service to some of your readers.

FREDERIC EGNER, Mechanical and Gas Engineer.

City Gaslight Company, Norfolk, Virginia, Jan. 1, 1880.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1880.

The following memorials, complaining of non-compliance with Standing Orders, had been deposited in the Private Bill Office on Friday, the 13th inst., that being the last day for depositing memorials in reference to the second hundred Bills on the list of petitions for private Bills:—

Rathmines and Rathgar Township (Vartry Water Supply) Bill, from (1) Rathmines and Rathgar Improvement Commissioners and others; (2) Edward Fottrell and others; (3) Robert Dalby Dalby and others.

The following Bills among the second hundred on the list will therefore go before the Examiners as unopposed:—Ackworth, Featherstone, and Purston Gas Bill; Birkenhead Borough Bill; Cardiff Water-Works Bill; Chester Gas Bill; Dartford Gas Bill; Dearne Valley Water Bill; Doncaster Corporation Water Bill; Edinburgh and District Water Bill; Hull Lighting Bill; Lancashire County Justices (Water) Bill; Lincoln Gas Bill; Liverpool United Gas Bill; Malton Gas Bill; Maidstone Gas Bill; Reading Gas Bill; South Metropolitan Gas Bill; Stafford Borough Bill; Wakefield Corporation Water Bill; Wandsworth and Putney Gas Bill; Wigan Improvement Bill; Yarmouth Water Bill.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

MONDAY, JAN. 12.

(*Before Vice-Chancellor* MALINS.)

SIMMONDS *v.* VESTRY OF RICHMOND.

This case, which has been before the Court on several occasions, arose out of a dispute that had taken place between the Southwark and Vauxhall Water Company and the Vestry of Richmond as to the supply of Richmond with water. The defendants, in sinking an artesian well, erected a steam-engine and pumps close to the premises of the plaintiff, who was the proprietor of a boarding-house, and the noise made, as well as the dust and dirt arising from the machinery, created such an intolerable nuisance that the plaintiff's lodgers left. Thereupon an action was instituted to recover damages and for an injunction, and upon a reference to chambers the Chief-Clerk, after inspecting the premises, awarded the sum of £250. This sum the defendants had offered to pay, as well as the costs after the date of the reference, and the "out of pocket" costs of the plaintiff; but the offer not being accepted, application was made for an order upon the pleadings for payment of the £250 and costs of suit.

Mr. PEARSON, Q.C., and Mr. BRADFORD appeared for the plaintiff.

Mr. GLASSE, Q.C., and Mr. GLENN, who appeared for the defendants, submitted that the Court had no jurisdiction to make such an order upon motion.

The VICE-CHANCELLOR, after reviewing the facts of the case, said the only question now to be decided was, who should pay the costs of the suit. He was surprised to hear it urged on the part of the Vestry that, upon a question so insignificant as the present, the cause should be carried to a hearing, and so delayed for another five or six months. The only question in the suit was whether the plaintiff had sustained damage, and that question had been answered. What else remained? Nothing but costs. The plaintiff was right in coming to the Court, remaining before the Court, and was right now; therefore he had no hesitation in coming to the conclusion that as she had succeeded she must have the costs of the suit throughout. He believed it would be acting in mercy to both sides to cut short such a litigation upon the motion; and the order of the Court would be for payment of the £250, with interest at 4 per cent. from the date of the Chief Clerk's certificate, to be paid within seven days, and the costs of the suit including the costs of the motions; in other words, the successful party would get all the costs of the suit.

GLAMORGANSHIRE ADJOURNED EPIPHANY SESSIONS.

TUESDAY, JAN. 13.

(*Before Mr.* R. O. JONES, *Mr.* J. C. FOWLER, *Mr.* G. PHILLIPS, *Mr.* O. H. JONES, *and Mr.* C. THOMPSON.)

APPEAL AGAINST THE ASSESSMENT OF THE SWANSEA CORPORATION WATER-WORKS.

An appeal was to-day heard, brought by the Swansea Corporation, as the Urban Sanitary Authority, against the assessment of the Churchwardens and Overseers of the parish of Mawr Higher, on one of the reservoirs of the water-works system, purchased by the Swansea Corporation and managed by them, situated in Mawr Higher.

Mr. M'INTYRE, Q.C., and Mr. DAVID LEWIS appeared for the appellants; and Mr. MICHAEL, Q.C., and Mr. BOWEN ROWLAND for the Overseers.

Mr. M'INTYRE, in opening the case, said it was an appeal made by the Swansea Corporation, who were the Urban Sanitary Authority, against the assessment of the Overseers and Churchwardens of the hamlet of Mawr, and the Assessment Committee of the Pontardawe Union, on the Blaenantddu reservoir, situated in the hamlet of Mawr, and which is one of four reservoirs, forming the group of reservoirs supplying the town of Swansea with water. The reservoir is a new one, recently constructed by the Corporation, and was assessed for the first time to the rate made on the 19th of April, 1879. The assessment then placed upon it was £1604. This was an assessment made by the valuer upon the rateable value of the works *per se;* but it was contended by the appellants that the works in any one parish could not be assessed at a higher rate than the proportion of the whole works would give to this one parish; and not that the works in any one parish, from which the actual income was derived, should be rated in excess of the others in such a way that a larger sum than the whole value would be derived from the accumulated amounts of the several parishes when joined together. The total capital expended in the purchase of the water-works, and the execution of permanent works since, amounted to £210,888. The actual cost of the reservoir which was the subject of dispute was originally to have been £49,748, which gave a net rateable value of £762, as against £1604, at which the works had been assessed by the Overseers of the hamlet of Mawr. In addition to this, there would be the owners repairs, insurance, &c., that the owners would have to pay, and which would amount to £190. This would give a gross estimated rental of £952, with a rateable value of £762. The difference between the amount assessed by the Overseers and the amount at which the works ought to be assessed to the Corporation formed the subject of dispute. The rateable value of the whole works was taken at £3255, and therefore he contended the rateable value of one of four reservoirs could not be £1604. The rateable value of the works, he maintained, should be based on the net income, and not on the amount the works would fetch in the market, because by their Act of Parliament the Corporation were not a trading company; as the surplus, after paying expenses, would go towards the reduction of rates.

Mr. *E. Cousins*, the Engineer and Borough Surveyor for Swansea, was the first witness examined. He said he had been with the Corporation for 25 years, and a part of the present water-works system was constructed under his direction. With the exception of the Lliw reservoir, and the

reservoir in dispute, the other works were constructed by the old Water Company. The Lliw reservoir cost £22,121; land, £5978; way-leave, £1895. The works were purchased of the old Company for £30,000. The land for the Blaenantddu reservoir cost £3571; way-leave, £16; the reservoir cost really £94,801; engineering expenses £2201; making a total of £100,589. The Lliw reservoir had a capacity of 300 million gallons, and drew its supply from an area of 1860 acres. The capacity of Blaenantddu reservoir was 160 million gallons, and the ground from which it drew its supply of water formed an area of 710 acres. The original expenditure was estimated at £43,689, but the additional expenditure was caused by the imperfect nature of the soil. Had the ground turned out what from the character of the adjacent soil they assumed it would, the reservoir would have been constructed for the sum originally estimated, or the total sum would have been £49,478.

In cross-examination he said that by their Act of Parliament the Corporation were compelled to construct the reservoir on the precise spot they did, as the place was indicated on the plans submitted to the Parliamentary Committee, and they could not vary the position, even to the thickness of the embankment. He admitted that the additional sum expended in the construction of the reservoir was necessary, and arose entirely from the faults in the soil, which gave a defective foundation. Had he been aware that the subsoil formation was of the character it turned out to be, he should never have recommended the Corporation to have constructed the reservoir upon the place where it was.

Mr. *T. W. E. Young*, the Borough Treasurer, stated that the total income from the water-works undertaking for 1878 amounted to £7795 3s. 11d. The establishment expenses were formerly put down at £500, but on the suggestion of Mr. Cousins the proportion of the establishment expenditure was increased to over £1000, as it was considered that the proportionment was unequal, and that a larger proportion of the Corporation expenses ought to be charged to the water-works undertaking. The receipts for 1879 amounted to £7999 3s. 11d., but the average income for the last three years had been £8472. The receipts amounted to a sum nearly equal every year. The arrears carried over would be from £1000 to £1200, but this would go on from year to year, so that the actual income from all sources would be about the same.

Witness was cross-examined at considerable length to show the amount of money borrowed for the construction of the Blaenantddu reservoir, £80,000 of which was borrowed at 4½ per cent.

Mr. *T. L. Headley*, Auditor of the Consett Water Company, said he had had great experience in the valuation of water-works. He had made a valuation of the Swansea works, having taken the details as supplied by the Borough Engineer. He considered that the proper way of estimating the value of such works was to take the gross receipts for, say, 1878, amounting to £7999. The working expenses were £2205, which was a very small percentage, leaving a balance of £5794. The working capital, stores, and material he estimated at £1000; meters, &c., £1500; making a total of £2500. He had not allowed any sum for cash balance, as the water-rents were payable in advance. The life of a reservoir he had estimated at 80 years, and then made a proportionate deduction for depreciation. These and other expenses reduced the balance to £4513, and this gave a rateable value of £3906 *plus* the rates, and it was upon this sum the rates would have to be applied, taking the works as a whole. Deducting the rates, there would be left £3251. That proportion as a rateable value to the gross receipts was about 40 per cent. This was a large percentage, as there were other water-works where the rateable value was less than 20 per cent. Taking the cost of the Blaenantddu reservoir at 1-64th of the whole, the rateable value of it was £762.

When cross-examined, he stated that the cost of a work was not the basis of its value, and in this case he had taken the cost of the reservoir at the sum originally estimated, and not at the cost it actually entailed on the Corporation.

WEDNESDAY, JAN. 14.

Mr. *Cousins*, the Borough Surveyor of Swansea, was again examined with reference to the contract entered into for the construction of the Blaenantddu reservoir, but this contract appeared to have been so materially altered that it became of little value.

Mr. *C. Stephenson*, a surveyor, and Mr. *T. Waring*, C.E., were examined with reference to the value of the Blaenantddu reservoir. Neither of these gentlemen had seen the reservoir, or been consulted before the previous day, when the case was opened. They had been furnished with the data given to Mr. Headley, and coincided with him in the rateable value which he placed upon the reservoir.

This was the case for the appellants.

Mr. MICHAEL then addressed the Court for the respondents. He contended that the basis of rating any works similar to those now the subject of inquiry was the value of things as they were, supposing that they were the property of a private company. The Swansea Corporation were bound by their Act of Parliament to construct the reservoir where they did, even though it should have cost them £500,000. The inhabitants of Swansea were dependent on this reservoir for their supply of water. The Lliw reservoir was so leaky that it could not be used, and it was obliged to be closed. The Corporation were, therefore, compelled to go to Parliament for an Act, and they borrowed £70,000, at 4½ per cent., to enable them to construct the reservoir. This was the principle upon which the rateable value of the reservoir should be based—the value of the reservoir to the whole, and the necessity of this particular reservoir to the supply of water to the town.

Mr. *E. Ryde*, of Westminster, was called as a witness for the respondents, and stated that he had had great experience in the valuation and purchase of water-works. He had seen the Blaenantddu reservoir at the request of the Assessment Committee, his opinion being asked whether their assessment could be maintained. He estimated that from £95,000 to £100,000 had been expended on its construction. The reservoir was most important to the Urban Authority, as it was from it that they drew their supply of water. The other reservoir was without water, and could not be used at the present time. It seemed to him also that the Blaenantddu reservoir was pretty freely bled, as the water in it, when he saw it, was very low. He considered, after a careful examination, that the rateable value of this reservoir was £3000. The Swansea Corporation paid 4 per cent. on their capital, and taking this as a portion of the whole, it would give £5000 for the reservoir. He considered that the sum named by the Assessment Committee, £1600, was not one-half what could be placed upon it by way of assessment. He then reviewed Mr. Headley's figures, and considered that the sum put down for working expenses, &c., was far too much. He considered that this particular reservoir was very material to the water-works undertaking. But for this reservoir, Swansea at the present time would have been, he believed, without water; and the reservoir, therefore, was most important.

In answer to the Court, witness seemed to think that while the reservoir was of a very great value, it might be that owing to the unproductiveness of the reservoirs in other parishes their rateable value might have to be reduced.

Mr. *Samuel Harpur*, Engineer of the Merthyr Local Board of Health, and Manager of the Merthyr Water-Works, also gave evidence. He valued the reservoir at a somewhat higher sum than Mr. Ryde, basing his valuation to some extent on the cost of the work, not upon its productiveness; but he gave several instances at Merthyr where the reservoirs cost widely different sums with smaller capacity. These, however, he said, were rated at their cost; but, after long pressing by the Counsel for the Corporation, he said he thought that they ought to be rated equally.

Mr. MICHAEL, in reply, urged that cost was an element in the consideration of the rateable value of the reservoir, and its great importance to the whole concern in its supply of water to the town of Swansea.

In reply to Mr. Jones,

Mr. M'INTYRE said that the water-works were rated in Swansea at £2047; parish of St. John, £200; parish of Clare, £374; St. Thomas, £346; Penderry Higher, £104; hamlet of Mawr for the Clive reservoir, £780; and for the Blaenantddu reservoir, £1604; the total rateable value being £5455. In addressing the Court on the part of the Overseers, he admitted that since the case had been before them a more careful investigation of figures showed that the rateable value of the reservoir, instead of being £762 as at first put down, should be £880, and it was this sum at which they now put it.

The Court then adjourned to consider their decision; and on re-assembling,

Mr. JONES said they had taken the gross value at £8000, on the authority of the case of *The Corporation of Worcester v. The Parish of Droitwich*. They had then deducted the working expenses, and various other items which he mentioned, reducing the rateable value to £4172. They had not taken the cost of the reservoir into consideration, but they had apportioned to the reservoir in dispute the rateable value of £1000. The rate would, therefore, be altered from £1604 to £1000.

Miscellaneous News.

EUROPEAN GAS COMPANY, LIMITED.

An Extraordinary Half-Yearly General Meeting of this Company was held at the London Offices, Austin Friars, on Wednesday, the 14th inst.—WILLIAM WHITE, Esq., in the chair.

The SECRETARY (Mr. Henry Dozell) read the advertisement convening the meeting, and the following report of the Directors:—

No events of importance, beyond the usual routine of the Company's business, have occurred since the annual general meeting held in July. The gasholders then in course of erection at Boulogne, Bolbec, and Sotteville have since been completed, and are now in action. At Nantes and Sotteville the execution of part of the extensions projected, including a new gasholder at the former station, has been deferred until the present year.

Generally the Directors are able to report that all the Works continue in good order, ready to provide the larger demand for gas which may be expected to arise from the revival of trade now taking place. Notwithstanding the depression which prevailed during great part of last year, the gas-rental shows that the interests of the Company have not been affected thereby, in the aggregate. At Rouen, Amiens, and Bolbec, however, prosperity is so much dependent on the active employment of the numerous and important factories established there, and which have in many cases either temporarily suspended operations or worked short time only, that gas has been less freely used than would have been the case under more favourable circumstances; but the falling off in this respect is more than covered by a large improvement elsewhere.

The demand for coke having become exceedingly active during the recent severe weather, an increase in price has been generally obtained, and stocks have everywhere been disposed of.

The Board have also the satisfaction to report that a great part of the supply of coals required at the Stations has been secured on favourable terms by means of contracts extending over two years, and shipping for conveying the same to destination having also been provided by agreements for a long period at low rates of freight, the Company are in a position to derive the full benefit of the rise in value of coke and other residual products, which has already set in.

Reviewing the whole of the operations since the 31st of March last, at the seven stations, it appears evident that substantial progress has been made, such as to encourage the hope that, when the accounts are made up to the 31st of March next, and the profits of the year ascertained, they will bear favourable comparison with any previous twelve months working during the existence of the Company.

Debentures bearing interest at 5 and 4½ per cent., to the amount of £17,000, came to maturity on the 1st inst., and were paid off, with the exception of £3800 renewed at 4 per cent. for a term of years.

The usual interim dividend of 4 per cent. will be paid on the 2nd of February next.

The CHAIRMAN: Gentlemen, having but little to say regarding the results of the past six months working, our report is necessarily a short one; but I think you will all agree that it is a satisfactory one. The main points are that our business is increasing, our residuals are becoming more valuable, and our raw material—that is, coal—has been secured for some time forward on highly favourable terms. In order to profit as much as possible by this state of affairs, we have limited the outlay on new works to the actual requirements of each station, whilst at the same time making sufficient provision for the future, deferring further expenditure where we could safely do so, as, for example, at Nantes and Sotteville, where, however, we still intend to carry out our extensions previously planned. Thus husbanding our resources, we trust that this time six months we may be privileged to lay before you such a statement of accounts as will ensure your unqualified approbation. The preliminary works relating to the deep-sea harbour at Boulogne have been energetically commenced, and as the present Prime Minister of France was one of the warmest promoters of the scheme, we may expect to see them continued in the same spirit. Our own interest, of course, cannot fail to be benefited by the large expenditure which is sure to be made there. We have suffered to some extent, as the report informs you, in what I may call our manufacturing towns; but Bolbec is fast recovering, and at Rouen the additional consumption from general lighting has compensated us for the suspension of the factories. At Havre the promoters of the electric light are making strenuous efforts to recover the ground lost by them; but the good sense of the Government officials in Paris has hitherto foiled all attempts to do so successfully. I believe the impression of the chief officials, on whom the decision depends, is that a similar effect to that produced by the electric light may be obtained at very much less expense from gas. Of course, you have all heard of the recent scare in gas shares. My conviction is that there is as little reason for it as there was for the previous one, which was from an alleged invention, now apparently set aside as worthless to make room for another, which does not appear to possess any greater practical value than to inspire telegrams at Christmas time, when they would be likely to produce the most effect on quotations. I am sorry for the weakness of any shareholders who may have been thus deluded into sacrificing their property; but, having been warned by experience, I must say I do not pity them for the losses they may have sustained. Even supposing Mr. Edison's cardboard light to possess all the merit claimed for it, is it likely that we could submit, in our shops and houses, to substitute for the great convenience of gas the intolerable trouble of vacuum lamps, liable to failure on the admission of atmospheric air, and deriving their supply of electricity from engines and generators placed in general on our own premises? It appears to me preposterous. In addition to this, the proposed lamps labour under the disadvantage of not affording any heat, which in gas is largely utilized as a substitute for fuel in factories, industrial establishments, and in private houses, during the winter months. I do not think I need say any more on the subject, nor should I have said so much, or indeed anything at all, if people's minds had not

been pre-occupied by it during the last few weeks. I am quite satisfied, as I have said before in this room, that the electric light of Mr. Edison is a very pretty plaything, and it is very much to his credit that he has produced it; but it is certainly not commercial. When you begin to talk of lighting houses and private apartments, and every man having the necessary machinery in his house, it is perfectly preposterous; and as to cheapness, I see by the paper to-day that he talks about something like an 80-horse power engine for 800 lights. Now, as far as my recollection serves me, an 80-horse power engine would cost for working about £3000 a year, with the necessary attendance, and then, to be safe, everything must be in duplicate. Therefore, I am quite satisfied, and I think the Shareholders may be also, that this is not a commercial way of lighting—it will not pay as a commercial undertaking. It is all very well for making speculative shares go up from 100 dols. to 3000 dols., but I am quite satisfied in my own mind gas has not anything to fear from it. I have nothing further to add to what you have already heard in the report, and I shall be happy to listen to any Shareholders who may desire to address the meeting on the Company's affairs. I beg to move—"That the report as read be now adopted."

Mr. H. SOLOMON seconded the motion.

Mr. T. N. STOKES thought the report was so satisfactory that no one had anything to say upon it. The Company seemed to be progressing, and he was sure this must be very gratifying to all the Shareholders.

Mr. R. H. JONES said he concluded that the £17,000 of debentures paid off would be really a reduction of the capital of the Company, so that for the future they would not have to pay the interest upon this sum which they had been paying.

Mr. H. M'L. BACKLER said that the money for the debentures paid off would be provided out of the depreciation-fund of the Company, and this fund was credited with interest out of profits, so that the interest would not really be a saving of revenue. It was a saving of expenditure so far, but revenue would not benefit by it.

The motion was then put, and carried unanimously.

The CHAIRMAN: As we have no accounts to place before you at this period of the year, that is the whole of the business.

Mr. STOKES said they could not think of leaving the meeting without giving the Chairman and Directors a hearty vote of thanks. Everything seemed to be progressing in the most satisfactory manner.

Mr. FREEMAN seconded the motion, which was carried unanimously.

The CHAIRMAN, in reply, said: Gentlemen, we have again to thank you for the vote of confidence in us which you have passed to-day. We endeavour to do our duty, and to look after your affairs; and I think we may say, and say very fairly, that while we do so we obtain our reward by the mode in which your business prospers. We think, as I said before, that we have very little to be afraid of as to the electric or any other light. As long as we can supply the towns, and different places where we supply gas, with the satisfaction we give at present, both to the authorities and to ourselves, I think we have little or nothing to fear. I thank you again for this vote of confidence in us.

The proceedings then terminated.

INSTITUTION OF CIVIL ENGINEERS.

The First Ordinary Meeting of the Institution after the Christmas recess was held on Tuesday last, when the recently-elected President, Mr. W. H. BARLOW, F.R.S., delivered an Address, in which it was stated that, his professional career having commenced in 1828, the same year as that in which the Institution had received its Royal Charter, he proposed to draw attention to the great changes and progress in engineering which had arisen since that time. Undeniably, he said, the influences that had mainly operated on the well-being of this kingdom, and on the world at large, were the improvements in the means of communication, by the application of steam to locomotion on land and on sea, and by the utilization of some of the powers of electricity in the transmission of intelligence. He then passed in review the progress that had been made in the use of steam for land and sea transport; and the origin of, and improvements made in the employment of electricity for telegraphic purposes, &c.

This naturally led to a reference to the use of electricity for lighting purposes, about which he said that the more recent electro-dynamic machines had placed lighting by electricity on a totally different footing to that on which it formerly stood, and left no doubt of its applicability to many important purposes. It was, in fact, already established in light-houses, where its intensity and power were of the highest value, and there were many examples of its application in public buildings and large shops, in railway stations and open spaces, and for street lighting. Whether it could be divided, so as to become equally economical and convenient for domestic purposes, had yet to be ascertained. The distinction between the intensity of light and its illuminating power ought not to be overlooked. The intensity of a light bore the same kind of relation to its illuminating power as the specific gravity of a substance did to its weight. The latest application of electricity—namely, for the transmission of mechanical energy—was suggested by Dr. C. W. Siemens, who had ascertained that, including all sources of loss, 50 per cent. of the original power could be realized at a distance of a mile, and that, with adequate provisions against heating, it would be no dearer to transmit electro-motive power to a greater than to a smaller distance. Sir William Armstrong had availed himself of this force for working a circular saw placed at a distance of quite a mile from the waterfall which supplied the power; the deep-sea sounding-line on board the telegraph ship *Faraday* was hoisted by mechanical energy thus transmitted from the engine; and Dr. Werner Siemens had succeeded in obtaining locomotive power sufficient to convey 30 persons by similar means.

In reference to gas, he said that its employment as a means of illumination, which was in its infancy in 1828, had increased in a remarkable degree. The capital invested in gas-works in the United Kingdom was £40,000,000, of which about £12,000,000 represented the capital of the London Gas Companies. At the end of 1878, the length of gas-mains in the Metropolis was 2500 miles, and there were about 58,000 public lamps for street lighting. In the same year the quantity of coal carbonized was 1,715,000 tons, which produced nearly 17,500 million cubic feet of gas, besides residual products of the value of £745,000. The coal used was about four-tenths of a ton per annum per head of the population. Of the gross revenue, 5 per cent. was derived from street lighting, 20 per cent. arose from the sale of residual products, and 75 per cent. from private consumers.

The application of wrought iron in the superstructure of engineering works having been touched upon, the President remarked that the improvements effected in the manufacture of steel assumed the character of new discoveries, which were tending to revolutionize the iron industries of the world; and, in conclusion, expressed his indebtedness to those men, both within and without the profession, in foreign countries as well as in this, who, by study and experimental research, were continually adding to an exact knowledge of the great sources of power in Nature—that power, the direction of which to the use and convenience of man, constituted the fundamental element in the Charter of the Institution.

METROPOLIS GAS SUPPLY.

METROPOLITAN BOARD OF WORKS.—At the meeting of the Board last Friday, a letter was presented from the Chelsea Vestry, asking the Board to take the necessary steps to procure, in the Bill to be promoted by the London Gaslight Company in the coming session, clauses requiring the Company to supply gas of as high an illuminating power, and of as great purity, as that furnished by the Companies under the supervision of the Referees. The letter was referred to the Special Purposes and Sanitary Committee.

METROPOLIS WATER SUPPLY.

The Registrar-General publishes the following table in reference to the water supply of London during December, 1879. According to the returns furnished to him by the Metropolitan Water Companies, 138,810,743 gallons, or 630,681 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight), were supplied daily; or 242 gallons (110·0 decalitres), rather more than a *ton* by weight, to each house, and 34·1 gallons (15·5 decalitres) to each person, against 33·1 gallons during December, 1878.

COMPANIES.	Number of Houses, &c., supplied in Dec., 1878.	Dec., 1879.	Aver. Daily Supply of Water in Gallons* during Dec., 1878.	Dec., 1879.
Total supply	553,975	573,792	130,086,702	138,810,743
From Thames	262,210	275,095	64,893,002	68,214,415
,, Lea and other Sources	291,765	298,697	65,193,700	70,596,328
THAMES.				
Chelsea	29,438	29,945	7,531,400	7,663,600
West Middlesex	51,493	53,534	9,487,730	10,115,826
Southwark and Vauxhall	82,183	88,502	23,898,285	24,440,378
Grand Junction	38,989	40,285	11,222,887	11,652,109
Lambeth	60,107	62,829	12,752,700	14,342,500
LEA AND OTHER SOURCES.				
New River	127,673	129,554	25,961,000	27,198,000
East London	117,084	120,459	31,105,700	34,877,000
Kent	47,008	48,684	8,127,000	8,521,328

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for December, 1879, as compared with that for the corresponding month of 1878, shows an increase of 19,817 houses, and of 8,724,041 gallons of water supplied daily.

The following is Dr. Frankland's report on his analyses of the water supplied to London during December, 1879:—"Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies, and by the Tottenham Local Board, was—Colne Valley, 1·4; Kent, 1·4; Tottenham, 1·8; West Middlesex, 1·8; Southwark, 2·8; Chelsea, 2·8; Lambeth, 3·2; Grand Junction, 3·4; New River, 3·6; East London, 3·7. The Thames water supplied by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was of superior quality, considering the season of the year, the West Middlesex Company's water being again distinguished by its comparative freedom from organic impurity. The Lea water, distributed by the New River and East London Companies, was slightly inferior to Thames water—a circumstance of extremely rare occurrence. All the river water was efficiently filtered before delivery. The deep well water supplied by the Kent and Colne Valley Companies, and by the Tottenham Local Board of Health, was of its usual excellent quality for dietetic purposes, and that sent out by the Colne Valley Company was suitable for all domestic purposes, having been softened before delivery. Seen through a stratum two feet deep, the waters presented the following appearances:—Kent, Colne Valley, and Tottenham, clear and colourless; West Middlesex, clear and nearly colourless; Chelsea, Southwark, Grand Junction, Lambeth, New River, and East London, clear, very pale yellow."

Results of Analyses expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.
Inner Circle.								
Thames—								
Chelsea	30·72	·138	·027	0	·224	·251	1·5	20·8
West Middlesex	32·50	·085	·018	0	·318	·336	1·5	20·3
Southwark	31·76	·130	·037	0	·341	·378	1·5	19·4
Grand Junction	32·78	·170	·038	0	·280	·318	1·5	19·9
Lambeth	32·72	·174	·016	0	·316	·332	1·5	20·6
Lea—								
New River	32·40	·183	·027	0	·266	·293	1·5	20·6
East London	37·24	·174	·046	0	·259	·305	1·7	21·2
Deep wells—Kent	44·08	·071	·016	0	·387	·403	2·5	25·1
Outer Circle.								
Colne Valley	12·28	·066	·015	0	·318	·333	1·4	6·0
Tottenham Local Board	40·78	·092	·015	0·70	0	·073	2·8	23·9
Corporation of Birmingham*	30·84	·132	·036	·003	·286	·324	1·8	19·8
Corporation of Glasgow†	2·96	·149	·022	0	·009	·031	0·64	1·1

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.

Note.—The numbers in the above table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

ADOPTION OF THE BURGHS GAS ACT AT MONTROSE.—A meeting of the Montrose Town Council was held on Thursday week, when Provost Japp, in accordance with the resolution, adopted at a preceding meeting, moved—"That the Council now adopt the Gas Act, and that a day be fixed in the month of November when they shall meet for the reconsideration of the resolution, as provided by the Act." Mr. Reid seconded the motion, which was eventually agreed to without dissent; and it was also agreed that the Council, after being reconstituted at the next election, should meet on Thursday, the 18th of November, to resume consideration of the matter. After a good deal of additional discussion, it was remitted to the Treasurer's Committee to confer with the Directors of the Gas Company, to ascertain at what sum they would be willing to sell the works, and to get other information.

AMERICAN GASLIGHT ASSOCIATION.

[Abridged from the "Official Report" in the *American Gaslight Journal*.]

(*Continued from p.* 65.)

At the close of the discussion on the "Lowe Water-Gas Process," reported last week, Major DRESSER read a paper prepared by Mr. W. Farmer, of New York, upon the results obtained by the use of the regenerator furnace for heating retort-benches, invented by Mr. Charles F. Dieterich, Engineer of the Baltimore People's Gas Company. This invention was described in a paper which Major Dresser himself prepared and read before the Society of Gas Lighting on Dec. 12, 1878. [See JOURNAL, Vol. XXXIII., p. 328.]

Major DRESSER also read a paper by Mr. E. S. Cathels, entitled "A Few Supplementary Words on Retort-Settings;" but as it was accompanied by, and had references to drawings which are not given in our American contemporary, it would be useless reproducing it.

Professor E. G. LOVE (New York) then read the following paper on

STANDARD BURNERS.

The question of a proper burner for testing the illuminating power of gas has created about as much, if not more discussion than that of a proper standard with which to compare the illuminating power. In 1849 the British Parliament first legalized a standard of the illuminating power of coal gas. The burner was described as an Argand of 15 holes, consuming 5 cubic feet of gas per hour, and having a 7-inch chimney. The candles were made of wax, six to the lb., and, as at present, intended to burn 120 grains per hour. In 1850, Dr. Letheby was appointed the first Gas Examiner, and to him are due many of the improvements in photometric work. Two years after his appointment, the sperm candle was substituted for the wax, and a plaited wick used.

The first public Act fixing a standard of illuminating power was the Metropolis Gas Act of 1860, in which the burner prescribed was an Argand of 15 holes, consuming 5 cubic feet of gas per hour, and having a 7-inch chimney; the standard of illuminating power was continued at 12 candles, and the candles employed were made of sperm. It will be readily seen that with these very imperfect specifications as to what the standard burner should be, a great variety of burners could be constructed, each conforming to that mentioned in the Act. Nothing was said about the apertures, and their distance apart, the diameter of the channel through which air was supplied to the interior of the flame, diameter of the chimney, and so on. As might have been expected, burners were made which did not show more than 50 per cent. of the illuminating power of the gas. It was noticed, however, that the smaller the holes and the greater the pressure, the lower the illuminating power; and, also, that as the channel for carrying air to the interior of the flame increased in size, the illuminating power was diminished. With this knowledge as to what a burner should not be, it became merely a matter of patient study and experiment to make a burner what it should be.

The Birmingham and Staffordshire Gas Act of 1864 contained a feeble effort to describe a standard burner; but it was still incomplete, although an improvement on those preceding it. The Birmingham burner, although well suited to a 14-candle gas, for which it was designed, proved unfavourable to the gas if the illuminating power was greater or less than this.

The Leamington, Dublin, and other burners were used more or less as standards; but the burner containing more good qualities than any other that had preceded it, and one which at the present time is quite extensively used, was that designed by Dr. Letheby, and made by Mr. Sugg, and now known as the Sugg-Letheby burner.

In the City of London Gas Act of 1868, an entirely new departure was made. By it Gas Referees were to be appointed, and, among other duties, they were to "prescribe the burner for testing the illuminating power of the gas," which burner should be the "most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer." The result of this Act was the adoption in 1870, of a burner constructed by Mr. Sugg, and known as Sugg's "London" Argand, No. 1. He gave the matter much careful study. The pressure under which the gas was supplied to the burner was greatly reduced; the air supply to the interior of the flame was carefully regulated by the diameter of the air-hole in the centre, while the air supply to the exterior of the flame was regulated by the length and diameter of the chimney; the temperature of the burner was also greatly reduced. While with a Sugg burner the pillow becomes heated to a distance of two or three inches from the top, with a Sugg's "London" the gas channels of the burner itself are not even warm. Calling the old test-burner used from 1852 to 1863, 100, the steatite burner used from 1863 to 1869 equalled 111·1, while Sugg's "London" Argand equals 128. The burner now used by the Gas Referees in London is practically the same as that adopted in 1870, and some changes in the dimensions of the chimney have been made.

There are three elements to be considered in the construction of a standard burner, or any burner calculated to utilize to the fullest extent the power of the gas—1. Size and number of holes. 2. Air supply. 3. Chimney. I am speaking now of burners of the Argand pattern. First, the size and number of holes. With common coal gas (say 16-candle gas) the holes can be of larger diameter and fewer in number as the illuminants are in moderate quantity, and too great surface of flame must not be exposed to the oxidizing action of the air. With richer gases the case is different. Here we have a larger percentage of illuminants, and the object is to spread out the flame, and allow the air a fair chance of bringing the carbon particles to incandescence. Hence the number of holes is increased, and they may be of smaller diameter.

The second and third elements—air supply and chimney—are closely related, because as we vary the dimensions of the chimney we vary the supply of air. The air supply is really the most important consideration, for on it depends the development of the maximum amount of light. A rich gas can stand and needs more air than a poor gas, inasmuch as in the rich gas we have more matter to be oxidized. The heated column of air caused by the burning gas creates a current of the surrounding air towards itself. This drawing in of the air is increased with an increase of the velocity with which the gas issues from the apertures; and the increase of the air-supply results in a more rapid combustion of the gas. It is possible to make the combustion too rapid, in which case the gas is over-burned. On the other hand, if the combustion is not rapid enough, a loss of light ensues, and we say the gas is underburned. As the combustion becomes more intense (by increasing the air supply) the *intensity* of the luminous portion of the flame increases, although the *extent* of the luminous portion is continually decreasing. With a deficiency of air the flame temperature is too low, and when there is too much air, its inert nitrogen is heated at the expense of the flame, and the carbon particles, mingled to a greater extent with the air, pass through the incandescent state too rapidly, or it may be the flame temperature is too low on account of the excess of air. There is a point, then, at which the carbon particles receive just the amount of air necessary to develop the maximum of light, and below and above which the gas suffers.

It is evident that as the chimney is increased in length or width, a greater quantity of air is drawn in on the flame, and so it may be over or under burned, according as the chimney is too large or too small. The flame will give its maximum of light on the verge of smoking.

There never has been a standard burner in the proper acceptation of the term. One burner after another has been adopted in certain sections, because the new comer was supposed to give more satisfactory results than its predecessors. This country has not, and never has had, any one burner which, by general consent, was accepted as a so-called standard. In England much more attention has been paid to the subject, and since the Gas Act of 1868, a certain burner has been adopted which utilizes the power of the gas so far as our knowledge of the principles involved will enable us to contruct one. This same burner is not used by all gas corporations in England even, and hence cannot properly be called a standard in the same way that we speak of standards of weight and measure. We have Sugg's "London," the Sugg-Letheby, and many more, each dubbed "standard." It probably never will be possible to decide on any one burner, and, except for the advantage of comparison, it is of little moment. In this country, if every gas company made the same kind of gas, and in the same way, we might settle on some one burner, but variety seems to be the order of the day. Burners were made for gas, not gas for burners, and it is very important to select a burner which is suited to the gas it is used to test. A burner adapted to a 16-candle gas will not burn one of 14 or 18 candles without injury to the gas, though sometimes it is possible to correct the evil by using a chimney of different dimensions.

Such is the case in using the burner prescribed by the Referees in testing the gas of London. If in testing a 14-candle gas by this burner it shows a tendency to tail over the chimney, the latter is changed for one of a slightly increased diameter. It then becomes an interesting question as to how far it is possible to decide on a burner which a majority of gas corporations can use to advantage. If one has always used the Sugg-Letheby burner, he could always continue doing so, and be able to compare the quality of his gas to-day with that of six months or a year previous. But if one company uses Sugg's "London," and another a Sugg-Letheby, there are no means of comparison, except, as we know, in a very general way, the increased illumination given by Sugg's "London" over the Sugg-Letheby.

Further than this, the question arises, and a question of much more scientific interest—How much light can be obtained from a given gas under the most favourable conditions. In these times of close competition, no gas corporation can afford to lose two or three candles illuminating power in the burner.

Every illuminating gas contains elements which, under favourable conditions, will emit a certain amount of light. The burner does not increase this light-giving power contained in the gas, but simply utilizes it to a greater or less extent, according to the adaptability of the burner to the gas.

That the gas company have a right to employ, in testing for illuminating power, the burner which will show their gas to the best advantage, is a fact generally conceded, and one which few, if any of you, will question. The intelligent consumer, on the other hand, has a right to demand that these tests be made with a burner which he can readily obtain. In other words, the company have no right to employ a burner of intricate construction, one likely to get out of order, or one so expensive as not to be within the reach of consumers. In most cases it will be found that the use of poor burners is occasioned more through ignorance than any inability to procure good ones. In England, of late years, great advancement has been made in the use of proper burners by consumers, and burners similar to those prescribed by the Referees can be readily obtained. We hear little of English burners in the hands of consumers in this country, because there is little thought given to the subject, and hence little demand for any other than the most simple forms. They are not so expensive, however, as to preclude their use in photometric work, so far as it may be advantageous to employ them.

The question is—Can a burner be wisely adapted for use by a large number of gas companies, unless there is some approach to equality in the gas manufactured by them? If one company makes a gas of 14 candles, and another company one of 18 candles, certainly no one burner can be used advantageously for both. If there were some standard of illuminating power, say 16 candles, and the different companies endeavoured to keep near this, a burner could be easily selected which, within reasonable limits, would answer for all. If a burner were to be adopted for what are known here as naphtha gases, it would need to be something different from that for coal gas. In England the Referees prescribe an Argand burner for common coal gas ranging from 14 to 16 candles, and a bat's-wing burner for cannel gas ranging from 23 to 28 candles.

I have had occasion to make some experiments on the subject in connection with a proposed change of burner in testing the gas of New York City, and, without occupying your time with details, will mention some of the conclusions to which I have been drawn.

New York is especially fortunate or unfortunate in the great variety of illuminating gases offered to the public. At present (and ever since the city has had testing-stations under its control) the Sugg-Letheby burner has been employed for all gases alike. That this burner was not doing full justice to any, and great injustice to some of the gases tested by it, was evident to every one; but, for certain reasons, no change seemed possible at the time. And even now that a change is contemplated, it is a most perplexing question to decide what burner or burners to adopt. To adopt one burner for all would be ridiculous. In the first place, there are gases, like the New York and Harlem, having an illuminating power of 16 to 17 candles (tested by the Sugg-Letheby burner) and the specific gravity of which is that of ordinary coal gas (·480 to ·480). Then there are coal gases corresponding very nearly or quite to the cannel gas of London, with a comparatively low specific gravity and high illuminating power, like the Manhattan—illuminating power 17 to 18·5 candles by the Sugg-Letheby burner, and specific gravity ·450 to ·500. And, lastly, those gases enriched with naphtha, having a high specific gravity (·650 to ·750) and high illuminating power. Up to the present time I have limited my experiments more especially to the first class, or common coal gases, as to this class belong the majority of illuminating gases of this country. Perhaps the average gas is more nearly equal to the English coal gas—from 14 to 16 candles illuminating power. For gases of this nature undoubtedly the best results can be obtained with Sugg's "London" Argand adopted by the Gas Referees. It is provided with a chimney, 6 × 1¼ inches for 14-candle gas, and another 6 × 1¼ inches for 16-candle gas.

Gases which range from 16 to 17 candles by the Sugg-Letheby burner cannot be tested by the Referees burner without some loss, as in every case I have tried the flame tailed over the chimney. Tests were made with the Referees burner and a chimney 7 × 1¼ inches, and good results were obtained; but, as will be seen later on, the maximum of light was not reached.

Experiments were made with Sugg's "E," "F," and "G" burners. Excellent results were obtained with the "E" burner, but with burners "F" and "G" the gas was undoubtedly overburdened, for the illuminating power was below that of the "E." It is to be borne in mind that these burners are designed for a certain consumption of gas (the "E" for 5½, the "F" for 6½, and the "G" for 7 cubic feet per hour), and it is hardly to be expected that they would give the best results when burning smaller quantities.

The following table shows some results obtained, while other experi-

ments are in progress. The gas used in the testings was that of the New York Company. The results given are the average of a large number of tests. The pressure of the gas as delivered to the burner varied from 0·15 inch to 0·30 inch, according as the bushing affixed to most of the burners was left in place or removed. In all cases, however, the pressure was reduced to a minimum consistent with an easy flow of gas. The tests were made with an hourly consumption of gas of 5 cubic feet, no matter what the capacity of the burner.

Burner.	Dimensions of Chimney.	Illuminating Power.	Illuminating Power by Sugg-Letheby Burner.	Difference.
First Series.	Inches.	Candles.	Candles.	Candles.
Sugg's "London" Argand, No. 1 .	6 × 1¼	16·83	15·95	0·88 tailed.
" " " " .	7 × 1¼	17·02	15·95	1·07
"E" burner	7 × 1¼	17·60	15·95	1·65
"F" "	7 × 1¼	17·40	15·95	1·45
"G" "	8 × 1¼	17·28	15·95	1·33
Second Series.				
Sugg's "London" Argand, No. 1 .	6 × 1¼	16·38	15·64	0·74 tailed.
" " " " .	7 × 1¼	17·16	15·64	1·55
Third Series.				
Sugg's "London" Argand, No. 1 .	6 × 1¼	Smoked.	16·22	—
" " " " .	7 × 1¼	17·28	16·22	1·06
"E" burner	7 × 1¼	17·80	16·22	1·58
"	7 × 1¼	17·20	16·22	0·98

From these tests it will be seen—1. That Sugg's "London" Argand, No. 1, with a 6 × 1¼ inch chimney, gave from 0·7 to 0·9 of a candle more than the Sugg-Letheby. This is low, on account of the tailing of the flame. 2. That the same burner with a 7 × 1¼ inch chimney gave from 1·1 to 1·5 candles more than the Sugg-Letheby. 3. That Sugg's "E" burner, with a 7 × 1¼ inch chimney, gave from 1·58 to 1·65 candles more than the Sugg-Letheby, while with a 7 × 1¼ inch chimney the difference is equal to about 1 candle. 4. That burners "F" and "G" gave from 1·4 to 1·3 candles more than the Sugg-Letheby. 5. That with a gas of 15·5 candles, by the Sugg-Letheby burner, most excellent results are obtained, by Sugg's "London" Argand, No. 1, with a chimney 7 × 1¼ inches. 6. That the Sugg-Letheby burner gives results about 1·5 candles below the burner giving the best results.

As to a suitable burner for rich coal gases and naphtha gases, I am convinced, from a number of experiments, that the burner which gives the best results with a rich coal gas will not burn the naphtha gases to the best advantage. A 5-feet bat's-wing is used in testing London cannel gas (23 to 28 candles), the gas of Glasgow (28 to 30 candles), and in other places. While this burner gives good results with rich coal gas, it is not suited to naphtha gas. A naphtha gas requires a flat-flame burner, the same as a rich coal gas, but one in which the slit is much narrower, so that the gas may be spread and a more intimate contact with the air offered. At the same time such a burner would over-burn rich coal gas. The simple matter of candle power is not the only element to be considered; the higher specific gravity of the naphtha gases is also to be taken into consideration.

Experiments on this point are in progress, and their results, together with the relations existing between the different burners, Sugg's illuminating power meter, and the jet photometer, will form the subject of another paper.

Mr. NETTLETON said one thought that presented itself to his mind was whether a standard burner or burners might not be established by the action of the Association, and adopted and used by the different companies throughout the country in fixing a standard by which to test the gas made, so that the Companies would be able to make comparisons with each other, and understand each other when the subject of candle power was discussed. There was a further thought, and it was this: The gas interests of the country were at some time, beyond all question, to be the subject of legislation; and if the gas interests of the country could present to the different legislatures and legislators an intelligent knowledge of the conditions necessary to a fair development and a fair standard of the gas made, they might have something in their own hands to guide legislation in the future to a large extent, and to relieve themselves, perhaps, from more or less oppression, by taking the initiative and acquainting the public and themselves as to what was necessary for a fair and just standard between themselves and the public. From the paper just read he saw that Professor Love's opinion was that no one standard could be made, and no one burner could be used; but a series of burners might be used, or some plan be developed by inquiry and investigation by which a standard burner for a 14-candle gas might have one kind of chimney attached to it, and another burner for a 16-candle gas have another chimney attached to it; and so going through with the different qualities and kinds of gas. In this way members would be able intelligently to talk with each other and understand what each other meant when speaking of the respective candle power of the gas they made.

Mr. LITTLEHALES suggested the desirability of gas companies, or the managers of gas-works, taking a little more interest than was often done in the burners used by consumers. There was no doubt a great deal of dissatisfaction caused in the minds of consumers because they did not get good burners. His company had for some time past been getting the best burners they could—not the highest-priced burners, but such as customers could afford to pay for. These were sold at cost price, and he believed it would pay every gas company to adopt the plan. Of one thing he was sure, and that was, that it would be to the interest of gas companies to look into this matter and see what could be done in the direction of furnishing good burners at a reasonable price to consumers. It very often happened, when complaints in regard to poor gas were made, that investigation disclosed the fact that the burners were poor, and thus a change of burners often remedied the difficulty.

Mr. STARR said he had been doing this for the last four years. He gave away the burners, and had altogether furnished about 100 gross to customers. Another thing, in putting the burners in, was to regulate the size of the burners used in the different parts of the house. For instance, where there were bed-rooms, he recommended the use of a smaller burner, and in a sitting-room, where a great deal of light was required, he recommended larger burners.

Mr. SHERMAN hoped the suggestion Mr. Nettleton made, in regard to standard burners, would be carried out by the Association. He (Mr. Sherman) thought a committee ought to be appointed to examine into this question, and therefore moved—"That a committee be appointed by the chair to investigate the subject of standard gas-burners, and to ascertain, if possible, which would be the best burner to be adopted by all the companies."

This motion was carried, and the PRESIDENT nominated Mr. Nettleton, Mr. Sherman, and Major Dresser as the Committee to report on the matter.

(To be continued.)

THE PRICE OF GAS IN PARIS.

It will be remembered that at the meeting of the Municipal Council of Paris on the 24th of November last, it was referred to the Streets Committee to inquire into the advisability, having regard to the improvements that have of late years been effected in the manufacture of gas, and the consequent reduced cost of its production, of applying for a Commission to consider the present position of the gas supply of the city, both public and private. The attention of the Council had been specially directed to the subject by a memorandum addressed to them by the Prefect of the Seine, and a number of petitions had been presented from the Syndical Chambers of various industrial bodies in Paris, who had taken up the matter with considerable activity.

By the 48th article of the treaty at present existing between the Municipal Council and the Paris Gas Company it is stipulated that if, in consequence of the discovery of any improved systems of manufacture, the cost of gas may be reduced, the Council shall have power, in the public behalf, to call upon the Company to adopt such improvements; and even if the Company should have already adopted them, and have thereby effected a reduction in their working expenses, the public are to participate proportionately in the benefit accruing therefrom, in the shape of a reduction in the price of gas. It is further stipulated that in the event of the discovery of a mode of lighting other than by gas, the Administration reserve to themselves the right of granting the necessary authority for the establishment of such new system, without being liable to indemnify the Gas Company in any way whatsoever. These stipulations are to be applicable only in periods of five years from the date of the treaty (Feb. 7, 1870), and no action is to be taken in the matter till one of such periods is drawing to a close, when all the improved manufacturing processes not actually in use are to be examined by a Commission to be appointed for the purpose by the Minister of the Interior, and they are to have an interview with a deputation from the Gas Company, and indicate such of the new processes as in their estimation are capable of practical application in gas manufacture. As the second quinquennial period will close on the 7th of February next, the matter was deemed to be one requiring immediate attention, and hence the reference to the Committee.

At the meeting of the Municipal Council on the 24th ult., the Committee presented their report, in which they stated that having considered the several matters referred to them, and consulted with the Director of Public Works, they were of opinion that inasmuch as, since the treaty of Feb. 7, 1870, came into force, the processes employed in the manufacture of gas have enabled the Company more advantageously to dispose of their residual products for industrial purposes, and that the sale of such products has undoubtedly resulted in a considerable reduction in the cost of gas as now made; and it appearing, from the petitions presented to the Council, that the Company have themselves introduced improvements into their manufacturing operations, by means of which they have very greatly reduced their working expenses—they were of opinion that the Council should, with a view to the public benefit, request the Minister of the Interior to nominate a Commission to inquire into the whole question, in accordance with the terms of the article in the treaty referred to.

The recommendation of the Committee gave rise to a short discussion; but the report was eventually adopted.

THE GREAT EDISON SCARE.

Under the above title the following article, which it is reported was written by Professor Tyndall, appeared in the *Saturday Review* of the 10th inst:—

What a happy man Mr. Edison must be! Three times within the short space of eighteen months he has had the glory of finally and triumphantly solving a problem of world-wide interest. It is true that each time the problem has been the same, and that it comes up again after each solution, fresh, smiling, and unsolved, ready to receive its next death-blow. But this peculiarity of his triumphs, though interesting from a practical point of view, is doubtless of too trifling a character to damp the joy of victory in Mr. Edison's own mind, since it appears in no degree to interfere with the plaudits with which his followers hail each fresh achievement—or, as we should rather say, bulletin—from Menlo Park. And thus not only is Mr. Edison to be congratulated on the happy past, but his friends may look forward to a long and equally happy future, crowned at periodical intervals by similar dazzling and final triumphs; for, if he continues to observe the same strict economy of practical results which has hitherto characterized his efforts in electric lighting, there is no reason why he should not for the next twenty years completely solve the problem of the electric light twice a year without in any way interfering with its interest or novelty.

But all this, we are told, is altered now. We are given to understand, by accounts from head-quarters, that this time Mr. Edison really has done it, and descriptions of the perfection and economy of the light are showered upon us which quite take away one's breath. That the light itself is all that its inventor could by any possibility desire will not surprise any one who has had experience with inventors; but it does startle us to be told that its cost will be only 1-40th that of gas. In the face of such definite assertions incredulity would seem to be a crime, and it would appear to be the duty of all gas directors to make forward contracts to deliver old iron in view of the immediate future when gas will be spoken of as a thing of the past. Curiosity, however, is such a persistent trait of the human mind, that one cannot repress a desire to know the exact details of this all-transforming discovery, and to form one's own opinion of the sources of its transcendent merits. Fortunately, the veil of mystery that has so long hung over the doings of Mr. Edison's laboratory has at last been drawn aside, and we are in full possession of the magic secret. It does not sound very wonderful after all. There is nothing new in the lamp. It is an ordinary incandescent lamp with a slip of carbon as the substance to give forth the light. The sole secret is that Mr. Edison makes the carbon out of burnt paper.

The discovery bears strong marks of Mr. Edison's handiwork. Like all the other so-called discoveries of his in connection with electric lighting (with one exception, of which we will speak presently), it is wholly without novelty, unless there be some unimportant details in the particular form of the connections and regulating mechanism, in which he has chosen to exhibit that ingenuity which he undoubtedly possesses, but which could have been as well arranged in a thousand other ways. The idea of a lamp consisting of a piece of carbon placed in a vacuum and rendered incandescent by the passage through it of a strong galvanic current is at least as old as 1845, when it was patented by King, and similar devices have since been continually proposed and employed by others. Experience, however, taught inventors (as it will probably teach Mr. Edison when he has a little more acquaintance with the subject) that a vacuum is a very awkward thing to deal with, and that much more satisfactory results could be obtained by placing the carbon in a non-combustible gas, such as nitrogen or carbonic acid. Accordingly recent lamps in which incandescent carbon has been used have generally been of that type. Such was the Sawyer and Mann lamp which excited so much attention in New York some twelve months ago, and which consisted of a thin rod of carbon in a receiver full of nitrogen. Of late we have heard nothing of this lamp, and we very much fear that it is another instance

of the fatal gulf between theory and practice, and that its disappearance from public view is due to the existence of some practical difficulties in the application of what seemed to be an ingenious idea. Other lamps are upon similar principles; the most successful one, so far as we can judge by report, is a French one, in which there are three small carbon rods in a closed receiver, the oxygen of which is consumed by the combustion of one of the rods, leaving the atmosphere in the receiver incombustible during the incandescence of the other two. Nor is there any more originality in the idea of procuring the carbon for such lamps from burnt paper or cardboard. That such carbon was very suitable for producing light by incandescence has long been known to electricians. Mr. Swan used it 15 years ago for an electric lamp on the incandescent principle, and, curiously enough, used it in the shape of a horseshoe, exactly as Mr. Edison is now using it; so that there must be something more than a resemblance between the two lamps, seeing that the carbon and the enclosing glass vessel (which may be of any shape) constitute the whole of the lamp proper. The use of this carbon was given up because of its want of durability—a difficulty which, however, Mr. Swan says that he has now got over; and it seems to be tolerably evident from Mr. Edison's own account that he has done little or nothing to remedy this defect, of which he is probably not fully aware. At any rate, it is clear that the carbons he uses are fragile in the extreme, for he says that they must be taken out of the mould with the greatest care, to prevent their falling to pieces.

The general result, therefore, is that Mr. Edison leaves the subject of the electric light precisely where he found it, so far as discovery is concerned. He has added nothing to our knowledge. The next thing to consider is, whether or not his lamp performs the practical service claimed; whether, in short, the method he adopts—by whomsoever invented—will in fact accomplish what is alleged of it. Considered in themselves, there can be no doubt that the tales that have come over to us about Mr. Edison's new discovery are in the highest degree improbable. The use of incandescence as a means of procuring light from electricity, without breaking the continuity of the circuit, has been known from nearly the beginning of the century, and all its advantages and disadvantages have been thoroughly studied. The result has always been to show that it is a very wasteful method of using the electric current when compared with the electric arc or the broken circuit of such lamps as the Regnier and Werdermann, which hold an intermediate position between the two classes. It possesses great advantages, which are obvious at first sight; but so great is the disadvantage of which we have spoken, that its use has been very limited, except for special purposes, as, for example, the little medical lamps for illuminating the cavities of the body to facilitate diagnosis. That this principle should turn out to be the enormous commercial success that Mr. Edison's lamp is represented to be, is in the highest degree unlikely, seeing that, as we have said, his lamp differs but slightly, if at all, from lamps previously known. Nor do the accounts themselves that have reached us tend to reassure us much. They show clearly that this lamp is more fragile and more difficult to handle than any of its compeers. They do not give us the least reason to think that it has any elements of success in it other than the bright character of the incandescence of carbon made from paper; and as such carbon cannot materially differ in its qualities from other kinds, and is even more liable to be heterogeneous and uncertain, this small advantage seems to be a very slight matter to build such high hopes upon. They do not suggest any way of getting over the difficulty which is met with in lamps constructed on this principle, of keeping the glass from getting dulled by particles of carbon coming off from the incandescent mass within it—a difficulty which would be peculiarly fatal to a vacuum lamp like Mr. Edison's, which cannot be cleaned on the inside. But, above all, there is a strong flavour of humbug about the whole matter. Every account—even those which Mr. Edison himself seems to have authorized—is written in a way in which no good electrician could write. We have a sensational account of the supposed discovery, where a thin filament of carbon is represented as having been accidentally tried with a strong current, and we are told, as of a newly-discovered marvel of science, that this carbon filament resisted an intense heat, and "proved in reality more infusible than platinum." As though every schoolboy who has dabbled in chemistry did not already know that carbon was incomparably more infusible than platinum, or indeed than any other substance. Then there are references to other electrical phenomena which have about as much to do with the matter as the processes of electrotyping would have, but all of which are ingeniously identified with the so-called discovery, as though they specially belonged to Mr. Edison's lamp. Thus it is explained that the current can be made to run a sewing-machine; and other potentialities are vaguely shadowed forth which are said to be dependent on a knowledge of the laws of electricity. Of course a continuous current can be made to do work in a thousand different ways; but what have the marvels of electricity in general to do with the question whether Mr. Edison's lamp is a good one? Again, there is the new dynamo-electric machine. Mr. Edison must, of course, come before the public in a state of complete independence of all other inventors; so he must not even get his electricity from the same sources as others. Hence, for a second time, he produces a dynamo-electric machine, which he calls by the pompous title of the Faradaic Machine. It merits this title only in virtue of its representing a state of knowledge more nearly that of Faraday's time than any machine in use at present. It is strange how Mr. Edison's efforts in electric lighting seem cursed with a total absence of originality. This machine, both in its separate parts and in its general arrangement, is the merest copy from other machines. Its principle, its arrangement, and everything about it are so utterly unoriginal, that really it is difficult to understand how Mr. Edison himself can fancy he has any claim to be considered its inventor. It only differs from the machines at present in use in that it is much what they must have been in their early forms, before their makers had learnt how to intensify the magnetic field in which the armatures rotate. He drops hints of machines that utilize 90 per cent. of the power applied to them. The correctness of this figure, if it is intended to apply to this machine, we cannot believe in. Such a percentage is about what is expected from a good machine on the Siemens, Gramme, or Brush principle, and it is simply absurd to suppose that this blundering imitation, which is destitute of all the special improvements which experience has suggested to their makers, can contend with these machines on equal terms.

All these circumstances and many others cause us to regard with utter distrust the glowing accounts of Mr. Edison's invention (if it is entitled to be called such) that reach us from New York. And, added to this, there is the remembrance of what happened some 18 months ago at the beginning of Mr. Edison's experiments on the electric light. Every one recollects how, in October, 1878, there came a telegram from New York that Mr. Edison had completely solved the problem of electric lighting, and how this telegram caused a tremendous panic in gas shares, sending them down to two-thirds of their previous value. Even the instructed, who could detect, in the very language in which the telegram was couched, evidence that it was framed either by or for persons who were ignorant of the subject, scarcely dared to imagine that such a telegram could have been allowed to go forth or to remain uncontradicted unless Mr. Edison had really obtained most important results, and was in a position to practically effect electric lighting at a reasonable cost. It is fortunate for Mr. Edison that public attention cannot remain very long fixed upon any one subject, and that by the time that a few months had elapsed people had ceased to think of him or his telegram. For we now know in what position he stood when that outrageous telegram was sent. And it is well that we are able to arrive at this from sources directly connected with Mr. Edison himself, for it would otherwise be impossible to convince any one of the true state of the case. Some six or eight months after this telegram, two patents, representing the latest completed results which even then Mr. Edison had obtained, came over to this country, and were made public amid the universal derision of all who knew anything about electricity.

The wonderful secret that was to solve completely the problem of electric lighting was the use of incandescent platinum (or an alloy of platinum and iridium, we forget which) to give light. It would seem that Mr. Edison has an irresistible passion for electrical antiquities. Not only is this one of the very oldest devices known, but it was actually patented in 1848 by Staite, though we doubt whether such a principle could even then have been the subject of a valid patent unless there had been something special in the form in which it was applied. We forget whether Mr. Edison attempted to patent his lamp, or even if he had any lamp at all at the time; but he certainly patented a regulator, which was intended to turn off the current when the heat of the platinum got too intense. This was a simple instrument of little or no merit, and deserving of no notice. We really do not know whether it was able to do its work; we have heard that it failed even to do that; but whether or not this was the cause is of no moment, for, so far as we have been able to learn, both the lamp and the regulator have, for all practical purposes, proved abortive. We have never heard of their being tried on any practical scale, or even of their being used at all outside of Menlo Park; and whatever may be Mr. Edison's love of perfection, we do not believe for an instant that, if he had got a really practical lamp capable of doing a fraction of what that was represented to do, he would have let months pass without its coming into the market.

But these two were not the only precious gifts which were then bestowed on the world by Mr. Edison. There was a third, to which no disparaging remarks as to its extreme simplicity could be applied. The second patent then taken out by him was for a wonderful dynamo-electric machine of a wholly new construction. We willingly give Mr. Edison credit for originality in this machine. Coils were fixed to the vibrating arms of a monstrous tuning-fork more than a yard long, and these, by the vibrations of the fork, were made to approach or recede from magnets, and thus currents were generated. If it were not actually in a patent taken out on Mr. Edison's behalf, all instructed persons would hesitate to believe that such an absurd arrangement could be seriously proposed at a time when such machines as the Gramme, the Siemens, the Lontin, the Brush, and a host of others were in existence, much less that it could be proposed by a man of Mr. Edison's advantages and fame. It is difficult adequately to express the ludicrous inefficiency of the arrangement; but one thing is abundantly certain, and that is that the person who seriously proposed it was wholly destitute of a scientific knowledge of either electricity or the science of energy. It is clear that he was tempted by the hope of getting out of the vibrations of the tuning-forks something more than the force he expended on them. No doubt he thought that vibration was so confirmed a habit with tuning-forks that they would vibrate on the merest hint being given to them. To those who remember the amusement that this wonderful invention excited among English electricians, it will be interesting to read the following passage from the latest authentic American account:—"Mr. Edison's first experiment in machines for generating the electric current did not meet with success. His primal apparatus was in the form of a large tuning-fork, constructed in such a way that its ends vibrated with great rapidity before the poles of a large magnet. These vibrations could be produced with comparatively little power. *Several weeks of practice* proved, however, that the machine was not practicable, and it was laid aside." We should very much like to know when these weeks of practice (not a very long trial for a new invention) took place. Not before the patenting, or it would never have been patented. Then it must have been after the patent was taken out—a matter which confirms the opinion held by most persons in England who were competent to judge of it, that no such machine had at the time ever been made (except, perhaps, on a small scale), and that the whole matter was a pure speculative suggestion. Remembering the unrivalled opportunities for experiment possessed by Mr. Edison, the fact that he took out this patent without any adequate preliminary trial—and we are convinced that a most superficial investigation would have demonstrated its worthlessness—is a striking lesson as to the reliance that must be placed on the accounts of the extent of the preliminary experiments to which his so-called inventions are subjected. We can assure Mr. Edison that it will require a long list of successes, not only announced but realized, to counteract in the minds of those capable of judging of it the effect of that absurd patent in convicting Mr. Edison of being a man with no scientific knowledge of electricity, and either so incapable of judging of the value of his work or so careless of his own reputation as to be ready to patent a machine which on a few weeks trial proves itself, on his own confession, to be an utterly worthless device.

These petty results, or rather the small fraction of them that he had obtained six months previously to their publication, represent all that Mr. Edison had actually completed when the famous telegram was sent. In other words, he had not the slightest ground for announcing that he had made any substantial advance in the treatment of the electric light, much less that he had completely solved its difficulties. Now we do not suppose for a moment that Mr. Edison would aid in giving currency to a report which he did not believe to be true. The most probable hypothesis is that he is an inventor who is absolutely intoxicated with his own reputation, and who has an unlimited belief not only in the efficiency, but also in the novelty of all that he proposes. In no other way is his conduct comprehensible. The exciting cause of the celebrated telegram could not have amounted to more than that, having thought a little over the difficulties of the rival plans for producing the electric light, he resolved to concentrate his efforts upon the oldest and the easiest—namely, incandescence in the continuous circuit. Having resolved in his own mind that this was the best form, his vanity treated success as so certain that we honestly believe he viewed it as a grand new departure in electricity, whereas it was only what hundreds had done before and hundreds will do again. Then he went on floundering through all that his predecessors had gone through before him; advancing knowledge not one whit, inasmuch as all his results were old, but still pressing on with the profoundest conviction that everything that came upon him as a novelty was new also to the world. It is only by keeping these things in mind that we can judge of the value of the recent reports of his successes, and we can come to no other conclusion about them than that without independent confirmation they are not worthy of credence. It is not that we do not think that Mr. Edison is likely to help in the development of electric lighting. On the contrary, considering his unexampled advantages, it is matter for surprise that so ingenious a man has not discovered something worthy of remark by this time. For he is undoubtedly an inventor of exceptional merit. Independently of the important share he has had in the development of quadruplex telegraphy, his success in the

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carbon and loud-speaking telephones shows that he is possessed of great inventive power and remarkable mechanical ingenuity. His other great achievement, the phonograph, would alone go a long way towards justifying his enormous reputation. But these successes seem to have completely turned his head. He allows the wildest reports of his doings to obtain currency. The same account to which we have referred speaks of his having recently invented an air-pump, a method of utilizing mining tailings, a sextuple telegraph, and a specific against headaches. This last child of his fertile brain is old enough to be christened, and rejoices in the mysterious name of Polyform, and the reporter goes so far as to state that Mr. Edison takes it himself. But this must surely be an exaggeration. Altogether he reminds us forcibly of the White Knight in "Through the Looking-Glass," and we expect soon to hear that he has

"Completed his design
To save the Menai Bridge from rust
By boiling it in wine."

It will be remembered that the White Knight also had invented devices for the preservation of his health. All these things make us feel that Mr. Edison is not capable of judging of his own performances, and confirm us in the belief that his latest idea is but a doubtful rival of many lamps that are already in the market. The calculation as to its costing 1-40th the price of gas is an utterly absurd one, even when read by the light of the meagre details on which it professes to be based. The most economical form of electric light is, and in all probability always will be, the arc-lamp, where it can be used on a large scale, and no form of incandescent lamp can approach it in economy of production. Yet engineers are very well satisfied if they can bring down its cost, even under the most favourable circumstances, to between 2-5ths and 1-4th the price of gas. We feel tolerably certain that the cost of Mr. Edison's lamp, even if it is otherwise practicable (about which we have a good deal of doubt), will be many times this. The only good point about the news is that Mr. Edison seems at last to have settled down to the useful detail work of trying various methods of improving the manufacture of carbon for electric purposes. This is much wanted, and Mr. Edison is exactly in a position to do it. But, supposing that a manufacturer of artificial carbons were to discover that it was better to use barley-meal than wheat-flour, or lump sugar than moist sugar, in their preparation, we should be considerably surprised to find him announcing himself to the world by telegram as being the greatest inventor of the age. In our opinion Mr. Edison's pretentious announcements are as little justified by the fact that he has satisfied himself as to what is the best form of carbon to use in the ordinary and well-known incandescent method of electric lighting, as a candle manufacturer would be justified in announcing that he had completely solved the problem of domestic lighting because he had devised a slightly improved candle-wick.

The New York Correspondent of the *Daily News*, telegraphing last Thursday, says: "Mr. Edison is in fresh difficulties, owing to the liability of his carbon horseshoes to break in use. He has stopped making the lamps until he finds the cause, which is supposed to be the admission of air to the globes by the cracking of the glass at the point where the wires enter."

THE WATER SUPPLY AND SEWERAGE OF PARIS.

(*Continued from p.* 63.)

The fourth and last section of M. Alphand's work, which deals with the subject of the utilization of the sewer waters of Paris, is divided into four parts, in which the Author treats of the inconveniences attending the discharge of the sewer waters into the Seine; the necessity for their purification; their utilization for agricultural purposes; and the advisability of procuring State aid in carrying out the work.

The refuse waters of Paris, brought down by the large main sewers, flow into the Seine, loaded with all the impurities of a great city, at the rate of about 3 tons per second; so that in the course of 24 hours the enormous bulk of 264,000 tons of liquid is poured into the river. According to the estimates of the Municipal Engineers, each ton of sewage in the two principal sewers contains fertilizing material in the following proportions:—The Clichy sewer contains organic and mineral matters to the amount of 2·327 kilos., or about 5 lbs.; the St. Denis sewer, 3·461 kilos., or about 7½ lbs. The greater amount of fertilizing material in the latter case is due to the fact of the contents of the Bondy sewer mingling with those of the St. Denis sewer at the outlet. Under present arrangements, therefore, the sewer waters of Paris, which are now discharged into the Seine, to its pollution, allow to be lost annually an amount of fertilizing material which for its nitrogen alone might be estimated as being worth not less than 13 million francs, or £520,000 sterling.

In this section also are summarized the labours of the Commission appointed to regulate the Water Supply in France, and, according to M. Alphand, the public are now in possession, either through the medium of scientific publications or from practically ascertained results, of sufficient data to enable them to determine which will be the best process to adopt for the purification of the sewer waters. These processes may be comprised under the three following heads:—(1) Chemical Purification; (2) Mechanical Purification; (3) Intermittent Downward Filtration. Then there is a mixed system, which would consist in first causing the waters to precipitate their heavy contents, of little fertilizing value, before being employed in agriculture. Having considered the merits of these several systems in great detail, the Author considers that the solution of the problem is to be found in the purification and utilization of the sewer waters for agricultural requirements. This system he considers to be so simple and rational, that he is rather surprised that there should be any opposition to its adoption.

After thoroughly examining the various questions raised in the course of an inquiry into the subject of sewage purification, the Commission already referred to were unanimously of opinion that the system of employing liquid sewage for irrigating land was, among all other processes in use, the one which had given the best results, not only for the purification of the sewer waters themselves, but also for the utilization of the fertilizing materials they contain.

Under the third heading in this section the Author examines the obligations imposed upon the City of Paris to purify her sewer waters, giving a description of the project presented to the Municipal Council in 1875 by MM. Belgrand, Mille, and Durand-Claye, and the opinion of the Council thereon. The inquiry conducted by Mons. H. Bouley; the further project considered by the Municipal Engineers in July, 1878; the objections raised against the proposal to extend the area of land irrigated in the direction of St. Germain, and the refutation of certain allegations as to the deplorable results of the irrigation system employed at Gennevilliers; the results to be anticipated from irrigation by sewer waters, and the researches of M. Marié Davy on the whole question—all these matters are very favourably considered by M. Alphand. On the other hand, he does not fail to eulogize the ideas and principles which he himself propounded before the Water Commission.

In the concluding portion of the work the whole of this interesting examination of the sewage question is summarized. The Author says he considers that in order to preserve the Seine from pollution by the sewer waters of Paris, it is necessary that they should be conveyed to a tract of land at St. Germain, which it is proposed to convert into a sewage purifying-ground. This scheme, he believes, will furnish a complete solution of the problem, and will be unattended by any of the objectionable consequences which some people have been led to expect will result from its adoption. In carrying it out, the city will undoubtedly have to make considerable sacrifice, seeing that about 8,000,000 frs., or £320,000 sterling, will have to be spent before operations can be commenced at St. Germain. But the whole city will gain by the work being done. The pollution of the Seine will cease, and this is at least a moral obligation on the part of the city, from which she cannot withdraw; on the other hand, the terrible circle of nightsoil receptacles which now infect the outskirts of Paris will be abolished by the adoption of the system of emptying the cesspools into the drains, the contents of which, after having been purified, will be returned to their natural course, without endangering the public health or causing any inconvenience to the inhabitants of the city.

Having considered in detail all the bearings of the question, M. Alphand comes to the conclusion that without an abundant supply of water it would be impossible to make the house closets wholesome, even by the adoption of the plan of discharging the excreta into the sewers. If the thorough flushing of the sewers were not guaranteed at all seasons of the year, this system of disposing of the contents of the closets would become a source of great danger to the public health. The completion of the entire drainage system is, says M. Alphand, the corollary of the conversion of these conduits into receptacles for the sewage of the city, now rendered necessary; and as a result of this it is absolutely imperative that the Seine should be cleansed by the adoption of such a system of treating the sewer waters as would allow of their being discharged either into the stream, or else into receptacles whence they could be withdrawn and employed for irrigation purposes. Furthermore, if the liquid sewage discharged into the sewers were not constantly diluted with a sufficiently large body of water, serious inconvenience might be the result.

The problem of ensuring the salubrity of Paris and its suburbs is, says M. Alphand, a very complicated one, and the city has already made great sacrifices in order to arrive at its satisfactory solution. She must finish her work by adopting some plan which embodies all the qualities necessary for ensuring the health of crowded populations—namely, the supply of a pure, wholesome water for domestic use, the complete removal of all refuse matters and flood waters by means of an adequate drainage system, and the exclusion of those waters from the river until they have been filtered and divested of every element of corruption.

[We should state that the substance of the report from which we have extracted the foregoing particular, appeared in the *Journal de l'Eclairage au Gaz*.—Ed. J. G. L.]

SUGGESTIONS FOR DEALING WITH LONDON SEWAGE.

By Major-Gen. H. Y. D. Scott, C.B., F.R.S.

[A Paper read before the Society of Arts.]

In compliance with a resolution passed by the Metropolitan Board of Works in November, 1857, a report was presented to them in the following year, by Messrs. Bidder, Hawksley, and Bazalgette, on the "Main Drainage of the Metropolis." In this report, the Metropolitan Board were told:—

The Referees say (Report, p. 9), "It would also appear that the black mud from the sewage contains a considerable quantity of organic matter, which is most deleterious. An immense mass of this fœtid mud has accumulated in the bed and on the banks of the river, and it is continually supplying to the water large amounts of soluble matter in a state of putrescence, and contaminating the atmosphere with most offensive emanations. It is probable that the unhealthy condition of many towns on the sea coast is caused by deposits from the sewers by mud of this character."

And Dr. Hofmann and Mr. Witt, at p. 7 of their report, employ the following forcible expressions:—"We cannot but emphatically insist upon it, that the formation of this mud-deposit in the river appears to us by far the most serious evil which results from the discharge of the London sewage into the river. We cannot too strongly urge this point upon public attention." In these conclusions (say Messrs. Bidder, Hawksley, and Bazalgette) we entirely agree, and although we are not disposed to think that the whole of this noisome mud results from the deposition of sewage matter, yet we are satisfied that a real and increasing evil has its origin in this source, and that this evil has already attained such proportions as to render it essential to the well-being of the Metropolis that means should be taken for its immediate and permanent abatement.

Any person who examines the state of the Thames, especially within the tidal reaches, whether above or below the Metropolis, will be satisfied that the periodical withdrawal of the water of the river from the muddy surface of its bed is, in the hot weather of summer, invariably succeeded by disagreeable emanations, only too plainly indicative of the decomposition of animal and vegetable organisms.

The main drainage of the Metropolis was eventually carried out in accordance with the recommendations of this report, so far as concerned carrying all the sewage to the present main outfalls. Since 1866 these outfalls have been in full operation, and have daily discharged the raw sewage of the Metropolis between the towns of Woolwich and Erith, the results being precisely such as might have been expected from the above evidence. It is true that, inasmuch as the sewage is now discharged into a larger body of water than formerly, and at a point more distant from the great centre of population, the evil effects are considerably mitigated, but they are the same in kind; and in 1877, Captain Calver reported to the Conservators of the Thames, by whom he had been commissioned to examine into the question, that the Metropolitan Board of Works ought "to be called upon at once to dredge away those portions of the accreted matter which interfere with the convenience of navigation;" and he concluded his report with an expression of his "hope that the sanitary and economical difficulties may, ere long, be solved, so that the noble Metropolitan river committed to their [the Conservators] care may be freed from a drawback which is impairing its convenience and usefulness, and which must continue to do so at an increasing rate without an effective remedy is speedily applied." The Metropolitan Board, on the other hand, contend that the discharge of the raw sewage is neither damaging the river navigation nor the health of the dwellers on its banks, and Sir Joseph Bazalgette maintained, at the Institution of Civil Engineers, "That the bed of the river had improved of late; that the improvement was not due to systematic dredging; and that the mud-banks were not formed by sewage."

Without entering further into the arguments adduced on either side, it is necessary, for the basis of my reasonings, to point out clearly that the three Engineers nominated by the Metropolitan Board to report to them on the main drainage of London, laid before them the following conclusions, which, indeed, having quoted the above-recited evidence, it would have been difficult not to have arrived at, viz.:—"That mud, containing much organic matter, derived, in great measure, from the sewage discharged above low-water mark, is deposited on the foreshores of the river, and there putrefies;" and, "That the condition of the stagnant mud is injurious to health." (Report, p. 95). Further argument is not necessary to show that what was true with respect to the admission of sewage into the river at several points, situated in and about London, must be true, though to a minor degree certainly, when the sewage is thrown into the Thames by two outfalls between Woolwich and Erith. It is impossible to believe that the organic matter of the sewage will wholly lose either its tendency to deposit on the bed of the river, or to putrefy when there, whatever changes may be made in the situation of the outfalls

The liquid and richest portion of the sewage of the 3½ million souls in London, who contribute to the contamination of the Thames, is, in the opinion of all chemists, after its admixture with water, irrecoverable, unless it can be utilized by irrigation; while the solid suspended matters —which all the Royal Commissions on sewage disposal have, one after the other, declared to be the most injurious part of sewage impurities—if they could be recovered, and be made into portable manure, would each year be worth more than a quarter of a million of money. That it is possible to accomplish this object to a large extent, I hope to be able to prove to you, in spite of all that has been said and written concerning the worthlessness of sewage manures. In this matter, as in many others, English people have rushed into extremes. From unbounded and childish trust in the wildest schemes, they have now ceased to put faith in any.

The object of this paper is, then, to show that if the investigations and analyses of the most eminent living chemists are correct, it follows that sufficient value can be recovered from the suspended matters of Metropolitan sewage, obtained by simple subsidence, and unmixed with bulky precipitating materials, to meet all the expenses of keeping such an offensive and injurious matter as solid sewage out of the Thames.

The first point for consideration will be the composition of the suspended matters of sewage, being those which I propose to utilize, and which, however deposited, whether by simple subsidence or precipitation by chemicals, are termed "sludge."

These matters consist, first, of the *débris* of human fæces, mingled with the solid dejections of animals washed from stables, courtyards, and the streets, and also of the *débris* of animal and vegetable refuse from our kitchens; and, secondly, of the mud and sand scoured from the streets. The first-named constituents possess nearly the whole of the manurial value, and it is important for our inquiry to ascertain of what fertilizing elements the fæces of a population consist. By ascertaining the proportion of these elements to the organic matter associated with them, we can arrive at the value of such refuse matters as consist partly of fæcal and partly of other organic substances.

The researches of Lehmann, Wolf, Röderer, and Eichhorn, from which tabular extracts are given by the Rivers Pollution Commissioners (First Report, p. 27), enable us to arrive at the composition of fæces with great certainty; and the analyses and investigations of Professor Way, carried on at Rugby, under the auspices of the Royal Commissioners on the Disposal of Sewage, will, when considered in the light given by the above extracts, assist materially in arriving at a conclusion respecting the valuable elements derived from other sources. With respect to the second class, or the detritus, as this is worse than useless, it may be rightly designated as a "profligate associate," deserving no other consideration than how to lessen it, since it still further degrades the value of a manure already too poor. In Paris, where they are rapidly carrying out a system which allows the solid fæcal matters to be recovered without admixture with detritus, the contractor can afford to collect them for the fertilizing elements which they contain; but we must deal with the matters as they arrive at the outfall, in which state the worthless ingredients greatly exceed in amount those which have a value.

The tables of Röderer and Eichhorn, above alluded to, give the annual weight of the fæces of a mixed population of 100,000 persons as 64,937 cwt., consisting of 957 cwt. of nitrogen, and 1347 cwt. of phosphates, which, reckoning the phosphate as tribasic calcic phosphate, will amount to 622 cwt. of phosphoric acid, and this assumption we may make without important error. From these figures it would appear that the nitrogen is to the total weight of the fæces as 1 is to 67·8; or, deducting the water, which constitutes three-fourths of the total weight of the fæces, the nitrogen is to the organic matter as 1 to 16·9; and the phosphoric acid is to the organic matter as 1 to 26.

At p. 29 of the Third Report of the Commissioners on the Disposal of Sewage, are given the results of Professor Way's experiments at Rugby, extending over 2½ years, samples being taken every two hours out of the 24. This series was divided into three periods; and, subsequently, two sets of samples were collected for five days a year later, and the ratio of the nitrogen to the organic matter, other organic refuse being now mixed with the fæces, will be found to be, on the average, as 1 of nitrogen to about 15 parts of organic matter.

From these results we can conclude, without much danger of error, that the sludge of the Rugby sewage, omitting all mineral detritus, is at least as rich as fæces in that most important element, nitrogen. As respects phosphoric acid, though it was otherwise at Rugby, no great difference exists in the case of London sludge as compared with fæces, as will presently appear. From the above different observations and sets of samples, the ratio of the phosphoric acid to the organic matter was for the Rugby sludge as 1 to 31·6.

At p. 47 of the Report on Metropolitan Drainage by Hofmann and Witt, an analysis is given of the insoluble as well as of the soluble portions of the sewage from Dorset Square, London, from which it appeared that the amounts of the above-mentioned substances per gallon were as 1 of nitrogen to 10 of organic matter, and 1 of phosphoric acid to 14·2 of organic matter.

Again, from some samples of sludge deposits, collected hourly throughout the day at Ealing, which were very carefully analyzed by Mr. Shepheard, F.C.S., in the laboratory of Dr. Frankland, the following results were obtained as the ratio of the nitrogen and phosphoric acid to the organic matter:—

$$\frac{\text{Nitrogen}}{\text{Organic matter}} = \frac{1}{26{\cdot}5} \qquad \frac{\text{Phosphoric acid}}{\text{Organic matter}} = \frac{1}{27{\cdot}7}$$

The foregoing sets of experiments were made under such different conditions as to time and place and length of trials, that it is somewhat difficult to arrive at a fair mean. But an unobjectionable course, perhaps, will be to compare the highest and lowest results with the composition of fæces, as given by Röderer and Eichhorn, and take care to err, if we do err, on the side opposed to that which we are endeavouring to prove. These results are as follows:—

	Highest.	Lowest.	Mean.	Fæces.
$\frac{\text{Nitrogen}}{\text{Organic matter}}$ =	$\frac{1}{10}$	$\frac{1}{26{\cdot}5}$	$\frac{1}{18{\cdot}2}$	$\frac{1}{16{\cdot}8}$
$\frac{\text{Phosphoric acid}}{\text{Organic matter}}$ =	$\frac{1}{14{\cdot}2}$	$\frac{1}{31{\cdot}6}$	$\frac{1}{22{\cdot}9}$	$\frac{1}{26}$

Dr. Letheby, after carefully comparing the results of his own analyses, which were very numerous, with those of Drs. Way and Voelcker, and the figures adopted by Dr. Hofmann and Mr. Witt in their investigations, came to the conclusion that in the suspended matters of town sewage the ratio of the nitrogen and the phosphoric acid to the organic matter was—

	From Excreta.	From all other Refuse.	From all Sources.
$\frac{\text{Nitrogen}}{\text{Organic matter}}$ =	$\frac{1}{15{\cdot}5}$	$\frac{1}{36{\cdot}6}$	$\frac{1}{20{\cdot}6}$
$\frac{\text{Phosphoric acid}}{\text{Organic matter}}$ =	$\frac{1}{16{\cdot}9}$	$\frac{1}{18{\cdot}7}$	$\frac{1}{17{\cdot}96}$

It would appear, from a consideration of the foregoing results, that, in different towns, owing chiefly to the influence of other refuse than excreta, the ratio of the fertilizing elements to the organic matters may vary considerably; but, looking to the results of the examination of the Dorset Square sewage by Professor Way, we may feel some confidence that the chief fertilizing elements in the London sewage sludge will be under rather than over stated, if we assume that—

$$\frac{\text{Nitrogen}}{\text{Organic matter}} = \frac{1}{20} \qquad \frac{\text{Phosphoric acid}}{\text{Organic matter}} = \frac{1}{25}$$

The potash is the third and only remaining valuable element found in sewage sludge, and, according to Dr. Letheby, it owes its presence entirely to the fæcal matters. Any potash present with granite detritus is not in a condition immediately available for plant life, and cannot, therefore, be reckoned as of any manurial value. From Professor Way's analysis, the proportion of potash to organic matter in fæces is as 1 to 18·6; but, from the analysis made by Dr. Voelcker, of the precipitated sludges of four towns named in Messrs. Rawlinson and Read's report—viz., Bolton-le-Moors, Bradford, Coventry, and Leeds—all of which, excepting Coventry, are deficient in fæces, the mean ratio is—

$$\frac{\text{Potash}}{\text{Organic matter}} = \frac{1}{51}$$

and from Professor Way's analysis of the sludge of the Dorset Square sewer, already referred to, the potash appears to have equalled the 1-56th part of the organic matter. I therefore adopt 1-56th as the proportion of potash likely to be found in the Metropolitan sludge. Recapitulating the results we have arrived at, we may assume, then, that with each part of the three fertilizers—nitrogen, phosphoric acid, and potash—there will be associated in the sewage sludge of London 20 parts, 25 parts, and 56 parts respectively of organic matter.

We have now to see to what extent these results will be influenced by admixture with detritus—the third, and by far the most variable, as well as the most worthless component of sludge. The detritus should on every account be excluded, as far as possible, from the sewers. At present, however, I shall limit my observations to the separation of the detritus from the more valuable organic matters when the sewage reaches the outfalls, with a view to its exclusion from the manure to be prepared from the sludge, as well as to its exclusion from the river. That this can be effected to a considerable extent will be evident from the valuable report of Captain Calver, from which I have already quoted. Captain Calver gives, at p. 16 of his report, two analyses by Professor Williamson—the first stating the amount, in grains per gallon, of the suspended and dissolved constituents of the sewage as it issued from the northern outfall sewer; the second, the amount, similarly stated, of the suspended and dissolved constituents of the sewage as it flowed from within the apron of the reservoir into the Thames two hours after high tide; that is to say, after the velocity of the current was diminished, and the sewage had deposited the heavier particles.

Contents in Grains per Gallon.

Suspended Matters.	No. 1. One Hour before Low Water.	No. 2. Two Hours after High Water.
Organic matters	37·21	104·97
Sand	44·10	23·52
Iron, alumina, carbonate of lime, &c.	26·67	23·01
Total suspended matters	108·01	151·50

For No. 1 analysis the $\frac{\text{organic matter}}{\text{mineral}} = \frac{1}{1{\cdot}9}$

For No. 2 „ „ $= \frac{2{\cdot}25}{1}$

The suspended matters in the sewage, when issuing from the sewer into the reservoir, contained only 34 per cent. of organic matter, and as the sewage issued from the reservoir into the river, the suspended matters contained, at one period of their flow, about 70 per cent. of organic matter. To this extent, therefore, it is manifestly possible to effect a separation of the sand from the more valuable constituents of the sewage. We require only, for the purpose of this separation, an additional reservoir for the subsidence of the lighter organic matters, after the heaviest mineral particles have been deposited in the existing reservoir.

From this second reservoir, in which I would propose that the sewage should have a period of quiescence, we might expect the sludge to show the following analysis:—

Organic matter (without nitrogen)	66·50
Nitrogen	3·50
Phosphoric acid 2·80 = tribasic phosphate of lime	6·07
Potash	1·25
Sand and inert mineral matter	22·68
	100·00

a result which corresponds very nearly with the composition of the sludge at Ealing, analyzed by Mr. Shepheard, already referred to. It is a little richer in nitrogen, however, as was to have been expected from the analysis of London sludges by Professor Way.

I should here remark that different analyses of London sewage vary considerably in the proportions of the mineral and organic matters. Dr. Letheby determined that the—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{1}{1{\cdot}36}$$

It would appear, however, from the analyses of London sewage given in the First Report of the Rivers Pollution Commissioners, to be—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{1}{1{\cdot}55}$$

and Professor Williamson's analysis, from Captain Calver's report, gives—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{1}{1{\cdot}9}$$

As the detritus imparts no value to the sludge, but has a contrary effect, we shall err on the safe side if we assume, as Captain Calver states, that—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{1}{2}$$

And we see that by a period of repose we may easily bring the ratio to—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{2}{1}$$

We must next inquire into the values of the fertilizing ingredients of the sludge—viz., the nitrogen, calcic phosphate, and potash.

(To be continued.)

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Business as a rule throughout the coal trade of this district is only quiet, the demand for house-fire classes of fuel being exceptionally dull for the season of the year, whilst for gas-making purposes there is also less being required. The result is that colliery proprietors are not at present able to get rid of all the coal they are raising, and there is a good deal standing in waggons on many of the pit sidings. Generally, however, prices for the better classes of round coal are maintained, but the advances which were in some cases attempted at the commencement of the month are not obtainable. With regard to manufacturing classes of fuel, although there is not yet such an increased demand as would justify any material upward movement in values, the improvement in the iron trade, and the greater activity prevailing amongst the cotton mills, are producing a more hopeful feeling, and there are very few colliery proprietors who will sell forward at present rates. Good classes of forge coal especially are firmer in price, and although there is a good deal of slack in the district, and in many cases stocks are increasing, there is no disposition to push sales, many of the colliery proprietors preferring to hold for the present, in anticipation of higher prices ruling in the market before long. The average quotations at the pit mouth may be given about as under:—Best Wigan Arley, 9s. per ton; second qualities and Pemberton four-feet, 7s. to 7s. 6d.; common round coal, 5s. 6d. to 6s.; burgy, 3s. 9d. to 4s. 3d.; good slack, 3s. to 3s. 3d.; and common, 2s. 6d. to 2s. 9d. per ton.

Business in the shipping trade is tolerably active, and good coal suitable for steamers use is in pretty brisk demand, the better qualities delivered alongside at Liverpool fetching from 8s. 6d. to 9s. per ton.

For coke a good demand is maintained, and gas cokes suitable for forge purposes are moving off pretty freely.

In the iron trade there has again, during the past week, been a strong upward movement in prices, but this has had a tendency rather to check business. As I have pointed out in previous reports, there is not, apart from forge requirements, that increased local consumption to warrant the extraordinary expansion of values which has recently taken place, and it is only the continuance of the demand for exports, and the nervous anxiety of some consumers to cover in anticipation any wants that may arise, which enables producers to maintain the prices they are doing. Local makers of pig iron, who are pretty well sold for the next two or three months, have made a further advance of 2s. 6d. per ton on their list rates, which for delivery into the Manchester district are now quoted at 70s. per ton, less 2½, for both foundry and forge qualities, whilst some of the outside brands have gone up considerably more than this. For finished iron, prices are little more than nominal, as very few makers are at present prepared to quote. For Lancashire crown bars, delivered into the Manchester district, the minimum price may, however, be given at £8 10s. to £9; for hoops, £10; and for sheets, £11 10s. per ton.

Amongst founders, engineers, and machinists there is not generally very much more doing, although a few of the large firms are busier, and there is, as a rule, a better feeling with regard to the future.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

If anything, trade was a trifle quiet in the North last week. The upward tendency of prices was hardly checked; but coalowners begin to take a more moderate view of the prospective rise in prices in 1880 than they did a month ago. In fact, they cannot be forced. If they were, the reaction would be awkward, or trade might be driven away to other districts. The gas contracts are completed for the half year, or near about, and very much will depend upon the local demand for coals, as to what the prices will be in the second half of the year. At present the rise in the value of manufacturing coal is not excessive. Coalowners are asking an advance of about 1s. per ton upon last year's prices. The price of best steam coal has advanced from 8s. 6d. to 9s. per ton, and the colliery offices anticipate making a further rise of 1s. per ton in March. The upward tendency in the price of coke is checked. A fortnight ago manufacturers were not much inclined to name a price for forward delivery. They are now willing to enter upon business at present rates. At the same time, while alluding to the position of the coal trade, it is only right to state that manufactories which have been closed two or three years are getting to work again, and that all the large chemical and iron works are very fully employed. But there is also something to set against this. A number of small collieries, too, which were closed through bad trade, and new workings which were stopped before seams of coal were reached, will resume when there is a good prospect before them. Very high prices in the coal trade can therefore hardly be expected in 1880. At the same time there will be a substantial rise in values, no doubt.

The freight market, especially coastwise, is somewhat dull; 4s. 3d. a ton being paid to a steamer last week to load coals for London over a period of four years. There are very few sailing vessels in the coal ports. Those seeking tonnage are scarce, but orders are at the same time limited. A deal more gas coal is being shipped for London and the coast by steamers which load regularly at the Tyne Dock. There was a strike amongst the seamen and firemen who are employed aboard the steamers trading to London and the South for an advance of wages, but the dispute was adjusted without any stoppage of trade.

There have been some more rather large sales of fire-bricks on the Tyne for shipment abroad. Prices are advancing in this trade.

The rolling mills and foundries on the Tyne are very busy; in fact, they have as much trade as they can stand to. Some idea may be formed of the improvement which has occurred in the manufacturing iron trade within little more than three months when it is stated that plates for iron shipbuilding were selling in September at £4 17s. 6d. per ton. Consett plates were disposed of last week at £8 15s. per ton. Chemicals keep firm for early spring shipments. A good business is expected from the United States in March. The price of lead is not quite so firm. The lead merchants are holding back recent arrivals from Spain.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual general meeting of the Macduff Gas Company was held a few days ago, when the balance-sheet and report for the past year were submitted and approved of, and a dividend at the rate of 6 per cent. was declared.

Now that the urgent demands upon gas manufacturing plant for the season 1879-80 have been met, it may be worth while to mention two or three facts with reference to the gas supply of Glasgow. The greatest consumption on any one day during the season now rapidly passing away was 11,331,000 cubic feet. That was on the 11th of December, which was one of several very foggy days. A good many industrial establishments were not in full swing, otherwise there would have been a much larger consumption. Then, in connection with the consumption, it may be mentioned that the total storeage capacity at the three works now going—Dawsholm, Dalmarnock, and Tradeston—amounts to 11,697,000 cubic feet. The works at the Partick station are entirely at a standstill, and are by-and-by to be dismantled. The largest number of retorts in use at any one time during the winter was 1455—on the 16th of December.

The Managing Committee of the Forfar Gas Corporation met on Wednesday last, and had under consideration the question of storeage accommodation at the gas-works. The members present resolved to recommend to the Corporation to minute that additional accommodation is absolutely necessary; also that the Manager, Mr. D. B. Esplin, be authorized to obtain contracts for extending it, either by erecting a new telescopic gasholder or by repairing and converting one of the three gasholders now in use into a telescopic holder. The Committee were of opinion that should the difference between the cost of erecting a new holder and the conversion of one of the present holders be relatively small, the erection of a new holder should be preferred. They further recommended that the purifying capacity should be about doubled—a step rendered necessary in the interest alike of the Corporation and the consumers.

There are some indications that the Johnstone Police Commissioners and the ratepayers generally are keenly regretting the acquisition of the gas supply undertaking on behalf of the town, at the price which was made imperative by the decree arbitral of Dr. Anderson Kirkwood, the Arbiter in the case. This came out very prominently at a meeting which two of the Commissioners held with their constituents during the past week. One of them, Mr. Hunter, in his speech, dealt very fully with the purchase of the gas-works, which he characterized as a costly blunder. The works were bought for £22,400, including arbitration expenses on the part of the Gas Company; but they had yet to pay all the expenses with regard to the arbitration on behalf of the Commissioners. Taking the interest which they required to pay for the money borrowed, and the amount necessary for providing a sinking-fund, the annual charge to the burgh on account of the works would, he said, be £1610. But the works, on an average, only realized as profit about £1050 per annum; so that he thought it was impossible to keep the price of the gas, as at present, at 5s. 5d. per 1000 cubic feet; and in answer to a question subsequently put to him, said he thought the price would have to be raised to 8s. 3d. per 1000 feet. Towards the close of his remarks, Mr. Hunter said he anticipated that in the course of a few years they would be able to give good cheap gas, but at present he could hold out no other prospect before them than this, that for the first year or so their gas-rates would require to be raised. It would not be necessary, however, that for all time to come they should pay £1610 per annum, for, by the aid of the sinking-fund, the amount would get less and less every year; and in 40 years both interest and capital would all be paid off, and the gas-works would be the ratepayers own property.

Buckhaven, in Fife, for a long time a benighted place, is now able to rejoice in having its streets lighted up with gas.

The water assessment for the town of Irvine has just been fixed at the rate of 2s. per £1 of rental.

At the statutory meeting of the Police Commissioners of Wishaw, held on Monday, the 12th inst., plans of a proposed reservoir in connection with the water-works, prepared by Mr. James Tait, C.E., were carefully considered and approved; and that gentleman was instructed to procure the necessary plans and statements forwarded without delay to the Board of Supervision, so as to obtain the loan of the required money before commencing operations. As shown on the plans, the works are expected to cost a little over £15,000 (including pipe track), irrespective of land. The reservoir is to hold 62 million gallons.

The completion of a new water supply scheme for the town of Castle-Douglas was formally celebrated with much rejoicing on Friday last.

An excellent water supply scheme has also just been completed for the town of Carluke, in the Upper Ward of Lanarkshire, from plans designed and carried out by Mr. James Tait, C.E., of Wishaw. The works embrace a reservoir of 10 million gallons capacity, seven miles of piping, 800 yards of a tunnel, and a built clear-water cistern capable of holding 85,000 gallons. It is expected that the assessment will not exceed a rate of 11d. per £1 of net rental, and the cost of the works will be about £7300. It is worthy of note that Carluke, Wishaw, and Motherwell all derive their water supply from the same parish.

Acting upon the advice given them by Mr. Gale, C.E., of Glasgow, in his report formerly referred to, the Parochial Board of Kilwinning have resolved by a large majority to take a supply of water for the Irvine water supply works, at a charge of 3½d. per 1000 gallons. Of course the Irvine Authorities have yet to consent to the offer; their own proposal being 4d. per 1000 gallons.

A large amount of business was done in the Glasgow pig iron market during the past week, but the speculative buying was less in amount. There was much sharp fluctuation in prices, and as high as 73s. 3d. cash was paid on Tuesday, but the best prices were not sustained, the close on Friday afternoon being 70s. 3d. cash and 71s. one month for sellers, and 1½d. less for buyers.

Local trade in coal is steady and improving. The disputes between the miners and the coalmasters are now practically all at an end, and most of the men that were out have resumed work almost at their own terms. Prices continue firm.

REDUCTION IN THE PRICE OF GAS AT RIBBLETON.—In answer to a deputation of the ratepayers of the township of Ribbleton, who waited upon the Directors of the Preston Gas Company to obtain a reduction in the price of gas, it was stated that the Company would agree to an immediate reduction of 5d. per 1000 feet, and the Directors promised a further reduction of a like amount when Ribbleton became more thickly populated.

NEWBURY TOWN COUNCIL GAS SUPPLY.—At the quarterly meeting of the Newbury Town Council last Tuesday, the report of the Gas Committee, which was presented, was accompanied by a statement as to the gas produced and consumed during the year ending Sept. 25, 1879. The quantity produced was 16,420,500 feet, and the quantity consumed and accounted for 14,862,748 feet, leaving 1,557,752 feet (or 9·48 per cent.) unaccounted for.

STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER SUPPLY.—At a meeting of the Joint Water Board of the above-named Corporations, on the Monday of last week, one of the officials applied for an advance of salary; but it was almost unanimously agreed to reject the application on the ground of the unfavourable state of the finances of the Board at the present time. It was observed by a member that the annual loss the Water Board were sustaining at present was from £3000 to £5000 a year.

NEGOTIATIONS FOR THE PURCHASE OF THE PONTYPOOL GAS AND WATER WORKS BY THE LOCAL BOARD.—The *South Wales Daily News* states that in consequence of a resolution passed at the last meeting of the Pontypool Local Board, a deputation of that body, consisting of the Chairman and the Finance Committee, waited upon the Directors of the Gas and Water Company, at the Town Hall, on Wednesday, the 7th inst. The scheme for acquiring the property of the Company was discussed, the Directors saying they were willing to sell at a fair price, but nothing definite resulted. The matter must now be laid before the various Boards of the district.

THE GAS SUPPLY OF RAWMARSH.—At the monthly meeting of the Rawmarsh Local Board last Wednesday, the Clerk stated that he had received

a notice from Messrs. George Wilson Stevenson and George Livesey, of London, who had decided on their award with regard to the transfer of the gas-mains of the Rotherham Corporation to the Rawmarsh Local Board, under the terms of the Rawmarsh Gas Act passed last session. The letter stated that the award had been placed in the hands of Mr. R. W. Cooper, of Westminster, and could be taken up by either party on the payment of £127 14s. 10d., the costs incidental to the award. On the motion of Mr. Whittaker, seconded by Mr. Goodinson, the Board expressed their willingness to pay half the cost of the award after it had been taken up by the Rotherham Corporation.

Scarborough Water Supply.—At the monthly meeting of the Scarborough Town Council, on Monday, the 12th inst., the Water Committee reported that the borings at Irton for an additional supply of water for the borough had been attended with success. The rock yielding water had been pierced to a depth of 102 feet, and the water now rose to the surface, and flowed away at the rate of 500,000 gallons per 24 hours; but in the opinion of Mr. E. Filliter, C.E., of Leeds, this quantity could be increased to a million gallons daily by aiding the flow by pumping. The water obtained is of excellent quality, and the Borough Analyst says it is "very pure, and thoroughly adapted for drinking and domestic purposes." The Committee recommended that the works should be proceeded with without further delay; and this was agreed to.

Lymm (Cheshire) Water Supply.—At the monthly meeting of the Lymm Local Board, on Friday, the 9th inst., Mr. Hall proposed, and Mr. Thomason seconded, a motion to the effect that it was desirable for the Board to enter into negotiations with the Lymm Water-Works Company for the purchase of their works. Some discussion took place, it being suggested that the Company would not be willing to treat for a sale of their property; and one member said he thought that if a meeting of the ratepayers were called, the majority of them would be found to be in favour of not purchasing the works. Subsequently the following resolution was carried:—"That it is desirable that a deputation from the Board wait upon the Water-Works Company, with a view of ascertaining whether the Company are prepared to sell their works, and upon what terms."

Death of Mr. H. Shrubsole.—Many of our readers will regret to hear of the death of Mr. Henry Shrubsole, Mayor of Kingston-on-Thames, who was well known to all frequenters of the committee-rooms of the Houses of Parliament, in connection with the firm of Messrs. Dyson and Co., of Westminster. Mr. Shrubsole was born at Kingston on the 21st of August, 1816, and therefore at the time of his death was in his 63rd year. Yesterday the Examiners of Petitions for Private Bills commenced their sittings for the present year, when the senior Examiner (Mr. Frere) referred, in affecting terms, to the sad event we have noticed. He warmly eulogized Mr. Shrubsole's high character and ability during his long career in practice as a Parliamentary Agent, and said his loss to the authorities of both Houses and to the profession was deeply deplored. Mr. Leslie, as President of the Society of Parliamentary Agents, in a few words expressed the sincere concurrence of all Mr. Shrubsole's professional brethren in every word that had fallen from the Examiner, their sorrow for his premature death, and their gratitude to the Examiner for his public recognition of Mr. Shrubsole's personal worth and exemplary professional character.

Bordeaux Gas Company.—The annual general meeting of this Company was held on the 18th of December, when the report and accounts for the year ending June 30, 1879, were presented. Although the profits on the year's working had, on the whole, been satisfactory, they did not bear a just proportion to the receipts, in consequence of large outlays having been necessary for the maintenance of plant and for extensions to meet an increasing consumption of gas. In the twelve months reported upon there had been sent out from the Company's works 477 million cubic feet of gas, which had produced a revenue of 2,058,958 frs. (£82,358), being an increase of 106 million cubic feet and 355,256 frs. (£14,210) on the previous year. The increase in consumption had been at the rate of 27·89 per cent., while the revenue from the sale of gas had progressed at the rate of 20·15 per cent. only. This disproportion resulted from an increase in the amount of gas supplied to the public lamps, for which no payment was made, and the reduction in the price charged to private consumers. The number of meters in use on June 30, 1879, had risen to 8548, or 89,961 burners; being an increase of 840 meters, or 8978 burners. The quantity of coal carbonized was 48,000 tons—an advance of 9000 tons on the previous year—and 5440 yards of new mains had been laid. After making all the usual deductions, there was a balance of profit on the year's working of 214,042 frs. (£8561), which it was proposed to divide as follows:—To the Shareholders, 105,000 frs. (£4200); founders shares—one-third of dividend, 35,000 frs. (£1400); balance to be carried forward, 74,042 frs. (£2961). The reserve-fund was increased to 65,296 frs. (£2612), and a dividend of 42 frs. 50 c. (£1 14s.) per share was declared, being an advance of 5 frs. (4s.) per share on the previous year's dividend.

Stoke Corporation Gas Supply.—The monthly meeting of the Stoke Town Council was held on Thursday last, when the Mayor (Alderman Turner) referred to the gas undertaking and the profits made therefrom since the works were transferred to the Corporation and the Fenton Local Board jointly. The works are still under the able superintendence of Mr. John M'Millan, the Engineer and Secretary to the Gas Committee; and to him, more than to any one else, must the credit of the satisfactory results reported be given. The Mayor said he found that in 1875 the gross profits were £4953; in 1876, £4034; in 1877, £4340; and in 1878, £6687; whilst in their (the Corporation's) year of making gas, the gross profits, after paying all expenses of working and repairs, were £7686, or £1000, in round numbers, above the best year of the Company. Taking the net profits, the figures stood thus: In 1875, £1933; in 1876, £814; in 1877, £940; in 1878, £3267; and 1879 (after paying all interest due), the clear net profit was £3717 6s. This, he thought, must be highly satisfactory to the ratepayers as well as to the Council. There was another point of importance, and that was the gradual increase in the consumption of gas in the district, which, he considered, would enable them to form some idea of the probable increase in the future. In 1875 the consumption was 64 million feet; in 1876, 68 million feet; in 1877, 76 million feet; in 1878, 83 million feet; and in 1879, 89 million feet, showing an increase of 6 million feet for that year alone. [The proportion of consumption in the two districts was: Stoke, two-sevenths; and Fenton, five-sevenths; so that, out of a clear profit of £3717 for the first year, Stoke received £2553, and Fenton £1163. He thought that the results of the purchase of the gas-works up to the present time had been very satisfactory, and if they could devote the whole of the profits made from the gas undertaking to the repayment of money borrowed by the Council (taking last year's profits as a basis), they would be able to clear off the whole of their debt in 15 years, if the profits continued the same during those years.

The Lower Thames Valley Main Sewerage Board.—As reported in the Journal for Dec. 23, a deputation of persons who considered their property would be injured if the scheme of the Lower Thames Valley Main Sewerage Board were carried out, had an interview with the President of the Local Government Board; and Mr. Sclater-Booth promised to give them his answer in writing. It may be remembered that, among other things, the deputation asked that, when a petition is presented to the Board by the Lower Thames Valley Main Sewerage Board for a Provisional Order to enable them to take compulsorily the lands mentioned in their published notices for the purpose of the disposal of the sewage of the united district, the petition may be dismissed by the Board without a local inquiry into the merits of the proposed scheme. It was urged by the deputation that the scheme is the same as that which was rejected by Parliament in March last, on the second reading of the Bill introduced by the Main Sewerage Board. In reference to this the reply sent by Mr. Sclater-Booth's Assistant-Secretary says: "The President desires to point out that one of the principal arguments brought forward in Parliament in favour of the rejection of the Bill was that the promoters should have applied to the Board for a Provisional Order, instead of to Parliament for a Bill, and the Bill having been thrown out on the second reading, no evidence was submitted to Parliament with regard to the merits or demerits of the scheme." Another point urged by the deputation was that the attempt to establish a sewage farm in the midst of the Thames Valley district is a direct breach of representations made in the session of 1877 to the Lords Committee by the witnesses for the Bill confirming the Provisional Order constituting the Joint Board; and concerning this the letter says: "It appears to the President that the main question before the Lords Committee was as to the expediency of a combination of districts for the purpose of the disposal of sewage, and the witnesses who were called in favour of the combination had no power to fetter the action of the Joint Board subsequently constituted. It would have been open to the Committee, by the insertion of a clause in the Bill, to have placed restrictions upon the Joint Board with regard to the scheme to be adopted by them, but it seems evident that the Committee had no intention to limit the discretion of the Joint Board in this matter." "With regard to Colonel Cox's report of January, 1876," the letter continues, "to which reference is made, it is true that Colonel Cox contemplated that more than one outfall would be required, but it must be remembered that this report related to the disposal of the sewage of a district of much greater area than that comprised under the jurisdiction of the Joint Board, and that in his subsequent report of March, 1877, he specially mentioned as one of the advantages of the establishment of a Joint Board that the great difficulty of obtaining sites for outfall works would be minimized, one outfall being required instead of eleven or more. In conclusion, the President desires to point out that it is a mistake to suppose that the Local Government Board are especially charged with the duty of protecting landowners from compulsory invasion of their property. The Joint Board was expressly constituted under the provisions of the Public Health Act, 1875, for the purpose of disposing of the sewage of the united district, and one of the powers conferred upon them by the Legislature, with a view to the discharge of that duty, is that of petitioning the Board for a Provisional Order to enable them to take lands compulsorily for such purpose. The President considers it important that reasonable facilities should be afforded to local authorities to enable them to fulfil the obligations imposed on them by law, and he thinks that any question as to the merits or demerits of the scheme could best be considered at the local inquiry, which would have to be held before a Provisional Order could be issued, and at which all persons interested could appear. Having regard to all the circumstances, it does not appear to the President that he would be justified in refusing to direct a local inquiry to be held into the petition of the Joint Board when it is presented. Such a course would be altogether unprecedented, and might have the effect of completely defeating the object for which the Joint Board was expressly constituted."

Register of Patents.

2695.—Mackay, G., Edinburgh, "*Improvements in the purification of liquids, and in the utilization and preparation of certain waste and bye-products of art and manufacture as purifying agents.*" Patent dated July 5, 1878.

This invention relates to improvements on patent No. 91, dated Jan. 11, 1875, and consists in passing the liquid, after the sludge has been precipitated, through filter-beds composed of the following materials in superimposed layers. For the first or under layer, rough gravel or broken stones; for the second, fine gravel; for the third, sand; for the fourth, pounded, distilled, or roasted shale, technically known as oil-works waste shale; and for the fifth layer, fine sand, perforated tiles, iron, zinc, or other equivalent capable of freely passing the water or other liquid, and at the same time preventing the shale from rising or being displaced.

2700.—Tomlinson, W. F., and Fearnley, G. B., Leeds, "*An improved self-acting apparatus for regulating the supply of gas.*" Provisional protection only obtained. Dated July 5, 1878.

This apparatus consists of a case of brass or other suitable material, inside which is a moveable cap or valve, made to cover the end of a perforated tube passed into the interior of the case at the bottom. The tube is pierced with longitudinal apertures, varying in accordance with the number of lights or size of the regulator. The gas by its pressure lifts the valve more or less in accordance with the pressure required, and it escapes into the chamber above, and thence through pipes direct to the burners.

In front of the valve is a pointer, which indicates on an index plate (by preference in the interior of the case) the rising or falling of the valve, hence the pressure or number of lights for which the gas is supplied. The valve is weighted in accordance with the average pressure required, and is self-adjusting. Such adjustment increases or reduces the area of the passage for the gas, and consequently produces an increase or decrease in the pressure, which is shown by the pointer being raised or lowered to numbers or other marks on the index plate. In order to see the index plate and pointer (these being within the case), there is an opening in the case, covered with glass and hermetically sealed.

2707.—Boulton, M. P. W., Tew Park, Oxford, "*Improvements in combined gas and steam motor engines.*" Patent dated July 6, 1878.

This invention consists, first, in cooling the cylinder of a gas motor engine, and utilizing the heat abstracted therefrom for the generation of steam by admitting water to the interior of the cylinder on one side of the piston; and, secondly, in an engine in which the combustion of an inflammable gaseous mixture is applied to produce motive power, employing, in conjunction with the products of combustion, steam generated from water applied to cool the cylinder.

2733.—Wise, W. L., Adelphi, London, "*Improvements in treating impure water or liquid to purify the same, which improvements are especially applicable to the treating of sewage to obtain certain products therefrom.*" A communication. Patent dated July 8, 1878.

This invention consists in treating impure water or sewage by mixing with phosphoric acid and subsequent addition of a solution of compositions

of protoxide of iron, of peroxide of iron, of alumina, and of magnesia, and finally lime water. Also in treating the liquid, after removal of solid matters by filtration, with a stream of passing cold or heated air.

2780.—Melling, T., Aigburth, Lancs, "*Improvements in and relating to apparatus for reducing or regulating fluid pressure, and for measuring and registering the pressures and quantities of water or other fluid flowing in given times through pipes or other conduits.*" Patent dated July 11, 1878.

This apparatus combines a pressure-reducing valve for liquids, the pressure of the liquid in the main being caused to act on a piston moving in a cylinder in front of the exit orifice. The pressure of the liquid in the exit-pipe acts on a piston so as to raise a weighted lever connected both to this piston-rod and the rod of the pistou which closes the exit orifice, so that until the pressure in the exit-pipe falls below the pressure required (and which can be regulated by shifting the weight on the lever), the pressure on the main valve will not open the exit orifice. The end of the weighted lever carries a tracer moving over a cylinder revolved by clockwork, thus tracing a diagram which indicates the quantity of fluid flowing through the apparatus in a given time. The pressure in the main is similarly recorded, as it varies from time to time, by means of a self-registering pressure-gauge, which is connected by a pipe to the main, and which draws another diagram upon the same revolving cylinder.

2826.—Carter, J., Eaton Square, London, "*Improvements in and relating to closed cisterns or tanks for containing water or other liquids.*" Patent dated July 15, 1878.

According to these improvements, the base of the air-supply pipe is expanded into, or securely attached to a conical or other shaped chamber, which in its turn is secured to, or made to form part of the top plate of the cistern or tank into which it opens. Within this chamber is a valve opening downwards, and arranged so as to be readily carried or floated upwards to its seat, and closed by the water as it rises in the cistern or tank and attempts to escape through the air-supply pipe. As the water is drawn off, the valve will fall or open, and thus admit the air through the air-supply pipe, and permit the water to flow out from the cistern or tank as required.

2839.—Newton, W. E., Chancery Lane, London, "*Improved apparatus for drawing or exhausting and forcing, injecting, or impelling fluid and liquid bodies.*" A communication. Patent dated July 16, 1878.

In the use of this apparatus, in order to set in motion gaseous or liquid bodies, a jet of steam or liquid under high pressure is made to act as an exhausting or motive agent, like the steam jet in a Giffard's injector. A jet in the form of a long thin film, or of the form of a knife blade, is caused to act on a thin vein or film of the liquid or fluid.

2840.—Spence, P., Manchester, and Illingworth, T., Leeds, "*Improvements in the manufacture of sulphate of ammonia, and in preventing nuisances arising from said manufacture.*" Provisional protection only obtained. Dated July 16, 1878.

In carrying out this invention the ammoniacal water or liquor of gas-works is pumped through coils of pipe or other such apparatus, whereby it may be heated by vapours arising from a part of the process which will hereafter be described. From thence it is carried to the top of a tower, say 6 feet in diameter and 30 feet high, filled with bricks, tiles, or other such materials, so as to leave numerous interstices. The liquor runs down over the surfaces of the materials, and runs out at the lower part into a boiler, and after running therein (say four hours) it passes into a second boiler. The first boiler is now supplied with a charge of milk of lime sufficient to set free the fixed ammonia, and steam (say of 50 lbs pressure) is blown into it, so as to boil and agitate it strongly, which process is continued until it is found by testing that all the ammonia is driven off. The first boiler is then emptied, and the steam diverted to the second boiler, the former being then ready for a second charge from the tower. Each of these boilers while being thus filled has a pipe passing to a condensing coil, and in which during the filling a quantity of crude ammonia is condensed, and is run into the gas liquor well. When the boiler is filled, this pipe is stopped. The steam from the boiler, charged with ammonia from the liquor, is now carried off by a large pipe, and conducted into the tower at nearly its bottom, and passes up through the interstices already mentioned, meeting the descending liquor and taking up its volatile ammonia; and all the vapour or steam so charged goes from the top of the tower to the blower, a leaden vessel containing an acid solution of sulphate of ammonia, and to which sulphuric acid is constantly added, and crystals of sulphate of ammonia are being constantly fished out.

The vapours being deprived of their ammonia by the acid, are carried off into a vessel which contains the coils of pipes above referred to, and in which, therefore, the liquor is heated before being carried to the tower. These vapours are then passed through a series of upright pipes or condensers exposed to the atmosphere until quite cooled, and all the water is condensed. The remaining gases, consisting of carbonic acid and sulphuretted hydrogen, are then passed into a furnace over a coke fire, and the sulphuretted hydrogen is burned and becomes sulphurous acid gas, and is passed into ordinary vitriol chambers to be made into sulphuric acid in the usual manner.

2845.—Richards, W., Stockwell, Surrey, "*Improvements in gas-regulators.*" Provisional protection only obtained. Dated July 17, 1878.

These improvements refer, first, to that kind of gas-regulator in which a bell and fluid are employed, and consist in constructing regulators in such a manner that the fluid necessary for their operation will not escape during transport; consequently the mercury, glycerine, or other fluid can be supplied to the instruments before being delivered to the purchaser. To attain this object the cover of the regulator is hermetically secured to the body, and to the cover is attached a pipe, or its equivalent, which protrudes some distance into the instrument, and serves as the outlet for the gas, as well as to prevent the mercury, glycerine, or other fluid employed, from escaping

Another part of the invention refers to that very large class of regulator in which a flexible diaphragm and valve are employed. In this it is proposed to make an orifice by preference in the plate which is attached to, and forms a part of the flexible diaphragm, and this diaphragm being weighted to give a certain pressure, the orifice in the plate is made of the required dimensions to deliver any given quantity of gas per hour. The orifice may be in any other part of the instrument where the pressure of the gas is regulated.

Another form of regulator is constructed by means of a disc working on a hinge, or with flexible material, and a fixed plate with an orifice in its centre, both of which are placed within the case of the instrument. Attached to the disc is a plug corresponding with the orifice in the fixed plate, the two forming a valve, which is closed or opened by the action of the gas on the disc, and thus the pressure of the gas is regulated.

Lastly, the improvements consist in the formation of a chamber, which may be combined with any class of street-lamp regulator, and in this chamber is fixed one or more diaphragms of wire gauze, perforated metal, or other porous or fibrous materials, by which any particles of naphthaline or other solid matter that might collect in the valve and impede the passage of the gas are retained in the chamber.

2873.—Sturgeon, T., Horsforth, Yorks, "*Improvements in machinery for compressing air or other gaseous fluids, and also for exhausting the same.*" Patent dated July 18, 1878.

In this machinery the seat of the inlet valve or valves is placed in the piston of the air-compressing or exhausting cylinder, and the inlet-valves are applied thereto, so as to move to and fro therewith, in such a manner that the valve may remain stationary while the piston is moved away from it to the extent of opening allowed, thereby opening the valve at the commencement of the forward or discharging stroke. In this case the piston-rod or connecting-rod is directly attached to the piston, the valve being loose and free to move independently to and from its seat therein, but is sufficiently retarded in such independent movement, by its own inertia, the pressure of air against its surface, and the momentum previously imparted to it, to allow the movement of the piston which effects the opening or closing of the valve to take place first, the valve then in its open or closed piston accompanying the piston through the remainder of the stroke.

2877.—Pass, E. de, Fleet Street, London, "*An improved self-acting apparatus for removing or withdrawing air or other gases from water-pipes and other water conduits, in order to regulate the pressure of air therein, and prevent bursting or other injury thereto.*" A communication. Provisional protection only obtained. Dated July 18, 1878.

According to this improvement a vertical cast-iron cylinder is fitted with a cover at one end and a flange at the other to secure it to the water or other pipe. An aperture lined with a metal socket is contrived in the cover, to allow the air which enters the cylinder to escape. Inside the cylinder is a second cylinder of tin open at its lower end, and in its lowest position it rests on a convex plate fitted in the lower end of the outer casing. The inner cylinder is closed at the upper end, and has an india-rubber washer to close the aperture in the outer cylinder, when the inner one, owing to the pressure of air, is forced to rise and come against it, and at the same time prevent the escape of the water in the outer cylinder.

2893.—Thompson, W. P., Liverpool, "*Improvements in the generation and production of gas for lighting, heating, and other purposes, and in apparatus therefor.*" A communication. Patent dated July 20, 1878.

This apparatus consists of a generator producing its gas by means of the passage into the middle of the carbonaceous fuel of a mixture of air and water or oil, by means of a blast-pipe, producing an eddying movement of the gases of the same kind as that caused by making them repass many times over the fuel and becoming reduced before being conveyed to the scrubber or washer; this gas being afterwards employed in gas-engines, heating, or in other industrial application.

2908.—Clark, A. M., Chancery Lane, London, "*Improvements in apparatus for exhausting and forcing fluids.*" A communication. Patent dated July 20, 1878.

In carrying out this invention, a horizontal drum mounted on a spindle is caused to revolve, the liquid to be forced being delivered to the drum. A stationary pipe placed parallel to the spindle projects down into the liquid where it is turned over at right angles, and is formed with a peculiarly shaped orifice. In this pipe the fluid is exhausted or forced, according to the direction of motion of the liquid in the drum relatively to the orifice and the construction of the pipe.

2941.—Ravenor, R., Speenhamland, Berks, "*Improvements in apparatus or appliances for attaching service-pipes to water, gas, or other mains while under pressure.*" Patent dated July 24, 1878.

A convenient way of carrying this invention into effect is as follows:—To the main from which the supply is to be taken, a cramp, which is made to correspond in shape with that of the contour of the main-pipe, is firmly connected; and, to the cramp, a stop-valve and stuffing-box. The main is drilled and the aperture tapped with a thread to correspond with that on the end of the service-pipe. The tool being withdrawn just above the tap or valve, the main is ready to receive the service-pipe, which is inserted in the valve as the boring-tool was. The upper end of the service-pipe is stopped by a plug screwed thereon, and the stop-valve is removed. A back-nut is now screwed on, and then a diminishing T connecting-piece with the house or premises; the plug is then withdrawn sufficiently far to allow full water-way, and a top back-nut placed on to keep the parts secure.

Where the pressure is excessive, means are provided for resisting the same on the tools and pipe by means of screw-cramp, jack, or other suitable appliance or tackle.

3045.—Clerk, D., Glasgow, "*Improvements in gas motor engines.*" Patent dated Aug. 1, 1878.

In this engine the power is developed in one single-acting cylinder, having combined with it a second cylinder used as a compressing pump, the two pistons being connected by rods to cranks on a first-motion shaft, which also carries eccentrics for working the valves. The air and gas are admitted to the pump by a valve, formed by a plate sliding between a port face and a cover, the air entering by a port formed through the cover, and passing into a passage leading to the pump, whilst the gas finds its way from an inlet port in the port face by a shallow cavity on the inner face of the valve into the passage leading into the pump. The air and gas pass into the pump when the piston moves outwards, and on the return stroke the mixture passes through a lift-valve into an intermediate chamber forming the back end piece to both cylinders. The mixture is then admitted to the main cylinder by a valve in the form of a plate sliding between a port face and a cover, the mixture passing first from a port in the port face through one port in the valve into a passage in the cover, and thence by a second port in the valve into the passage leading into the cylinder. Between the cylinder passage and the cover passage is a bundle of platinum heated sufficiently to explode the mixture. The platinum is heated by a cavity in the port face supplied with the mixed air and gas from the reservoir, which issues through wire gauze and is ignited, its flame playing on the platinum, which is lined with asbestos. When the platinum is not in position to ignite the charge, the valve communicates, on the inner side, with cavities in the port face communicating with the exhaust-pipe.

3051.—Calderwood, J., and M'Cutchon, W., West Calder, N.B. "*Improvements in or connected with the furnaces or heating apparatus of retorts and stills for obtaining or treating mineral oils or gas, and also applicable to steam boilers and to other boilers or evaporating vessels.*" Provisional protection only obtained. Dated Aug. 2, 1878.

This invention has for its object to obtain increased efficiency from the fuel employed for heating retorts, and consists in leading the gaseous products of combustion, after operating on the retorts, through flues, so as to utilize a large part of the heat remaining in them in the heating of fresh coal.

3056.—Leichsenring, H. R., Grossenhain, Germany, "*Improvements in and relating to engines worked by gas or other fluid, partly applicable to apparatus for compressing fluids.*" Patent dated Aug. 2, 1878.

In this improved form of engine, so as to prevent irregularity in the action of the gases in the engine, arising from their being badly mixed, they are conducted from the reservoir by two pipes, one leading from the highest,

and the other from the lowest part of the reservoir. The pipes are united before reaching the engine, thus obtaining a second mixture of the gases. For controlling the admission, ignition, and emission of the gases, a cock is employed having a particular combustion space filled at every revolution with gaseous compounds to be ignited in it. The regulation of the engine is effected in such a manner that in the highest position of the governor the outlet port of the cylinder will be held open, and the admission of the gases into the cylinder prevented until the engine has regained its usual velocity. In order to effect equilibrium in the slide, it is pierced on its side towards the cover, and the areas of the openings made equal to those on the other side.

3068.—KESSELER, C., Berlin, "*Improvements in self-regulating gas-burners.*" A communication. Patent dated Aug. 3, 1878.

This invention relates to a self-regulating gas-burner provided with a special valve-adjusting piece or seat, whereby the valve is lifted, according to the different pressures of the gas, to different heights, this adjusting piece also allowing the whole top surface of the valve to be invariably presented to the inner pressure of the gas. The burner is further provided with a regulating or set screw, in order to adjust the consumption of gas from the outside.

3153.—SUGG, W. T., Vincent Street, Westminster, "*Improvements in gas-regulators.*" Patent dated Aug. 9, 1878.

This invention relates to that class of gas-regulators in which a disc is used to carry a regulating valve, and by its rise and fall under the varying pressure of the gas to determine the rate at which the gas shall be delivered to the burner.

The regulator may be described as consisting of a shallow cylindrical chamber, pierced with holes at the bottom for admitting gas from the supply-pipe, and closed at top by a cover, which is formed with a central hole through which the supply of gas passes to the burner. Standing up from the centre of the chamber is a guide-pin, upon which works a disc that fits the chamber loosely. From the centre of this disc projects a stem carrying a conical valve, which, as the disc is forced up by the pressure of gas on its under side, will rise and throttle the escape opening in the centre of the cover. The disc is pierced with holes which will permit of a given discharge of gas per hour through the disc to the burner. When, however, the pressure is in excess, the disc will rise and the throttle-valve be set in action as explained.

In order to ensure the efficiency of this gas-regulating apparatus, it is necessary so to fit the disc in its chamber as to prevent the gas passing round the periphery of the disc, and so giving an undue supply to the burner. To provide for this, the disc is made of a sufficient depth at its periphery to allow of a ring groove or ring grooves being turned therein to receive a fluid packing; or recesses that will answer the purpose of the groove may be adopted. To the periphery of this disc glycerine, almond oil, or other equivalent non-adhesive liquid is applied, the action of which will be to close the space between the disc and the inner periphery of the chamber gas-tight, leaving the disc free to move under the varying pressures of the gas. By maintaining a supply of this liquid packing to the contact surfaces, the maintenance of the efficient action of the gas-regulator for a long period is ensured, and at the same time the necessity of accurate and costly workmanship in the regulator itself is avoided.

3168.—KINCH, T., Heaton Norris, Lancs., "*A new or improved valve for making connections to water and gas mains under pressure, and method of operating the same.*" Provisional protection only obtained. Dated Aug. 10, 1878.

This invention consists in the application of a ball-valve for making a connection to a gas or water main whilst under pressure, when using apparatus constructed according to Penney's patent, No. 101, of 1878 [see JOURNAL, Vol. XXXIV., p. 443], or other like apparatus.

In the present invention a screwed spigot is employed, terminating in a valve chamber, which is arranged to contain a loose ball made of gutta-percha, india-rubber, or other suitable material. This valve closes self-actingly against a seating by the pressure of the gas or water, and so acts as a valve, and the valve chamber is provided with a union joint.

The invention further relates to a method of opening the ball-valve against the pressure and in the act of connecting the service-pipe to the valve chamber, and consists in prolonging the "ground-in" nose of the male portion of the union (the tail of which is connected to the lead or other service-pipe in the ordinary manner) so as to project through the seating of the valve into the valve chamber, the prolongation being perforated or formed with passages therein to allow the gas or water to pass through, and terminating preferably in a shallow cup or socket which is designed to force the ball off its seating as the union joint is being screwed together, and thus to open a thoroughfare between the main and the service-pipe.

3202.—KIRKHAM, T. N., Abingdon Street, Westminster, and CHANDLER, S., jun., Newington Causeway, "*Improvements in valves.*" Patent dated Aug. 13, 1878.

This invention consists in constructing valves of a tubular form with lateral apertures, which form the outlet from the interior of the body. The upper part of the casing forms an annular recess, in which the mechanical arrangement for opening and closing the ports is placed. This consists of a tangent wheel and screw, by means of which a plug that fits accurately to the inner face of the valve, is caused to rotate, and thus opens or closes the egress passages. The tangent wheel is carried in a recess formed on the external casing, and the wheel is actuated by a cranked handle or other equivalent. The upper part of the valve casing is enclosed by a cap, by removing which the interior of the valve may at any time be readily inspected.

In a modification of the above arrangement, the arrangement for actuating the plug consists of a bevel pinion, fast on a spindle, which projects through a lateral gland. The bevel-wheel gears with an annular rack formed on the upper part of the plug, so that by giving motion to the spindle, the ports are opened or closed as desired.

These valves are applicable to many purposes, but they are particularly suitable, the inventors state, for relieving retorts from pressure; as, if the valve is arranged so as to form a portion of the dip-pipe, a clear and unobstructed passage is provided for the rapid egress of the gas to the hydraulic main, and without interfering in any way with the general working.

3225.—BOYNTON, L. W., Hartford, Conn., U.S.A., "*An improved liquid-meter.*" Patent dated Aug. 15, 1878.

This invention relates to a liquid-meter constructed with a cylinder having a double piston, with a space between its heads, operating in the cylinder in connection with a slide-valve and a valve-case containing a main valve placed within a chest connected with the cylinder. A lever pivoted below the valve-case extends down through the exhaust port into the space between the heads of the double piston in the cylinder, and is connected at its upper end with the slide-valve. By means of this valve and the arrangement of ports in the cylinder and valve-case the valves and piston are operated.

3257.—HILLS, F. C., Deptford, "*Improvements in the manufacture of sulphate of ammonia and apparatus to be used in the said manufacture.*" Patent dated Aug. 17, 1878.

These improvements consist in causing the ammonia so to combine with the sulphuric acid used, that at one stage of the process there may be an excess of ammonia in the liquor, and at other stages an excess of acid, so that the iron or arsenic, or both, that may be contained in the acid will be precipitated.

One form of apparatus for carrying out the invention consists of a combination of three vapour-tight vessels or saturators of any convenient size, lined with lead, and set at different levels, and so connected by pipes that the liquor may run from the first saturator into the second, and from the second into the third, the pipes being so arranged that the liquor in each saturator may be kept at a convenient height. When the ammoniacal liquor is being distilled, the ammoniacal vapour is conveyed by pipes from the still into the first and second saturators. The ends of these pipes, which should be perforated with small holes, dip into the liquor in the saturators, and are covered by it. The pipe from the still into the second saturator is provided with a valve or stopcock, for the purpose of regulating the quantity of ammoniacal vapour to be admitted from the still, and the gases escaping from this saturator are conveyed by a pipe into the first saturator. The end of the pipe should be perforated with small holes, and be covered by the liquor in the saturator, and the liquor, being acid, will take up any ammonia that may pass into it. The first saturator is connected by a pipe with the reservoir of acid.

The apparatus acts as follows:—At starting, the first and third saturators are charged with acid, or with sulphate of ammonia liquor having an excess of acid in it, and the second saturator is charged with liquor having an excess of ammonia in it. The ammoniacal vapour from the still is then caused to pass into the liquor in the first and second saturators, the quantity passing into the second being so regulated that the liquor in it shall continue to have an excess of ammonia kept in it in order that any iron or arsenic held in solution by the acid may be precipitated. While the ammoniacal vapour from the still is so passing into the saturators, sulphuric acid from the reservoir is admitted into the first saturator to neutralize the ammoniacal vapour passing into it, and to keep the liquor therein with excess of acid. As the sulphuric acid flows into the first saturator, the sulphate of ammonia liquor formed flows therefrom into the second saturator, and thence into the third, in which the liquor is kept slightly acid by a regulated stream of sulphuric acid. From this saturator the liquor flows into settling-tanks, and is allowed to settle, after which it is evaporated to obtain crystallized sulphate of ammonia. The waste gases generated in the still and in the first and third saturators may be conveyed away by pipes in any way desired; and liquid ammonia may be used in the second saturator instead of ammoniacal vapour from the still, to keep an excess of ammonia in that vessel.

For distilling ammoniacal liquor or gas liquor it is preferred to use a modification of the tower still or column still, the modification consisting in the substitution, for the plates or diaphragms ordinarily used, of troughs placed in the still side by side in rows, one set being placed above the other, and spaces being left between them, through which the steam and vapour rise, and the liquor being distilled descends. Or instead of using either plates or troughs alone, both plates and troughs may be used in the same still, the plates being placed between the rows of troughs.

3264.—PRITCHARD, E., Great George Street, Westminster, "*Certain improvements in joints for earthenware and cast-iron pipes for sanitary, drainage, and other like purposes.*" Patent dated Aug. 19, 1878.

This improved joint consists substantially in moulding, casting, or otherwise permanently attaching upon the spigot end of the pipe two or more half threads, the inside of the socket of the pipe to which it is to be attached being moulded or cast with corresponding grooves. There is also provided a collar upon the spigot end. A complete joint is formed by covering the spigot and socket ends of the pipe with a layer of cement or other equivalent material, or substance of a like character, and screwing the two pipes together. By a slight turn or rotation of the pipes or either of them on their axes the connection is made.

Instead of attaching the threads upon the spigot end of the pipe, the pipe may be moulded or cast without any threads on it, and instead it may be provided with suitable grooves, in which threads are afterwards placed and secured.

APPLICATIONS FOR LETTERS PATENT.

117.—ROBINSON, H., Manchester, "Improvements in gas motor engines." Jan. 10, 1880.

135.—RODGER, W., and COCHRANE, A. L., Selkirk, N.B., "Improvements in treating impure liquids, and in separating or removing solids and impurities therefrom, and in apparatus to be employed for these purposes." Jan. 12, 1880.

139.—BOUGHTON, R., Queen Victoria Street, London, "Improvements in lighting." Jan. 13, 1880.

171.—LAKE, W. R., Southampton Buildings, London, "An improved apparatus for regulating or controlling the flow of gas or other fluids." A communication. Jan. 14, 1880.

179.—YATES, C. D., Margate, Kent, "An improved apparatus for heating water, and an improved atmospheric burner in connection therewith." Jan. 15, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2946.—MORGAN-BROWN, W., Southampton Buildings, London, "Improvements in water-meters, also applicable to measuring steam." A communication. July 19, 1879.

2978.—DAVIDSON, S. C., Belfast, Ireland, "Improvements in rotary engines, pumps, and meters." July 22, 1879.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

4967.—STOBER, J., and PUGH, C. H., "Improvements in retort-lid fastenings." Dec. 23, 1876.

4988.—HALLEWELL, R., "Improvements in gas and water motor engines, and in gas motor engines." Dec. 23, 1876.

97.—COLLINGE, T. A., and PATERSON, T. O., "Improvements in the production of material for and method of purifying coal gas, and in apparatus used for that purpose." Jan. 9, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

38.—BISCHOF, G., "Improvements in the purification of water and in the means and apparatus employed for that purpose." Jan. 3, 1873.

45.—CROLL, A. A., "Improvements in means or apparatus for the distillation of ammoniacal liquors, which improvements are also applicable in the distillation of other liquids and in the concentration of soluble salts." Jan. 4, 1873.

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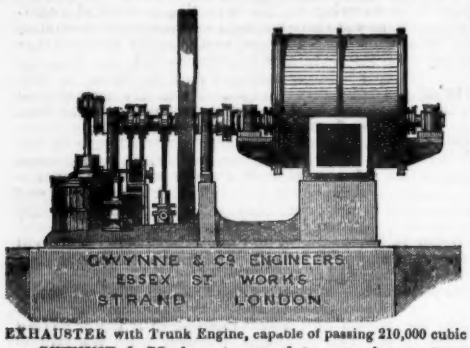

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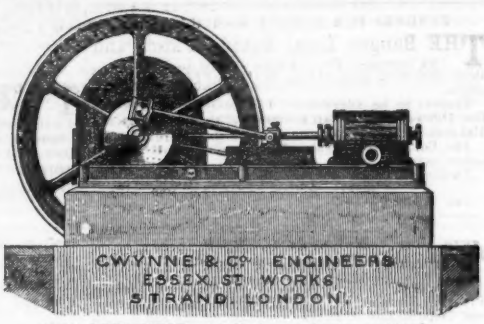

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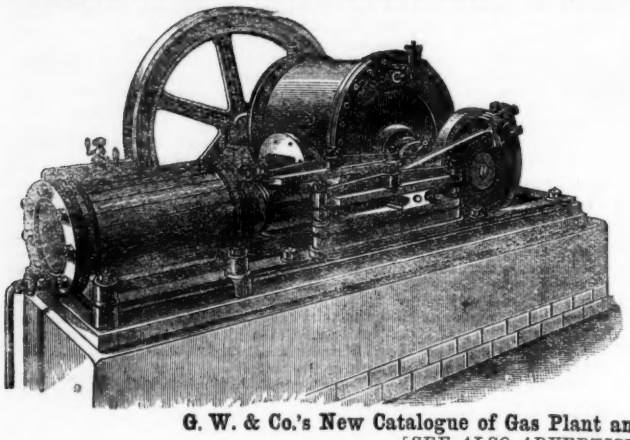

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WANTED, by the above Company, a Steady Sober man as STOKER, and to make himself generally useful at the Works. One accustomed to a Boiler and Steam-Engine preferred. Wages 26s. per week.

Apply, with references as to ability and character, stating age, and whether married or single, on or before the 26th of January inst., to

RICHARD HOLMES, Secretary.

Arundel, Jan. 15, 1880.

WANTED, by the Hindley Local Board, a GAS MANAGER. Make about 28 millions. Salary £120 per annum, with house, coal, gas, water, and rates free.

Applications, stating age, &c., with recent testimonials, to be sent in not later than Monday, Jan. 26th, 1880, addressed to the Chairman of the Gas Committee, Local Board Offices, Hindley, and endorsed "Gas Manager."

By order,
STEPHEN HOLT, Clerk to the Local Board.

LOUGHBOROUGH GAS COMPANY.

WANTED by the above Company, a CLERK who has been accustomed to the routine of a Gas Office. The person appointed will be required to assist in the Taking of the Meters, and likewise the Collecting of the Gas Accounts. Office hours from 9 a.m. to 6 p.m. Salary £50 per annum.

Applications to be sent in to me by Monday, the 26th of the present month.

J. B. BALL, A.I.C.E., Manager.

Jan. 12, 1880.

WANTED, an Engagement, by a young Man, aged 27. At present and for the past four years Manager of a medium-sized Gas-Works, the profit of which during that time he has increased threefold. First-class DRAUGHTSMAN and ACCOUNTANT. Thoroughly conversant with all matters appertaining to the Manufacture and Distribution of Gas. Well up in the Manufacture of Sulphate of Ammonia. Twelve years experience. No objection to go abroad. Excellent testimonials, and references to present and past employers.

Address No. 619, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Manager and Secretary of the Totnes and Bridgetown Gas Company, Limited.

The duties, which will occupy the whole of the Manager's time, consist of the General Superintendence of the Works and the Manufacture of Gas, Surveying and Supervising all Public and Private Works and Services, Giving Orders for all Stock and Goods required, Keeping the Books, Attendance at all Meetings, and such other duties as from time to time may be determined by the Directors.

Applications, by letter, stating salary, to be made on or before Friday, the 23rd inst., to

FREDK. BOWDEN, Secretary *pro tem.*
6, High Street, Totnes, Devon.

FOREMAN Wanted, at once, in a Provincial Gas-Works making between 40 and 50 million cubic feet of gas per annum. Must be a competent Retort-Setter, and well acquainted with the general routine of a Gas-Works. A good cottage, fuel, and light provided.

Apply, by letter, stating age and wages required, to No. 621, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE.—Several Volumes of the JOURNAL OF GAS LIGHTING, from 1863 to 1877, inclusive; half bound, and in good condition.

Offers may be addressed to No. 620, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS-FITTERS AND PIPE-LAYERS, &c.

THE Bangor Water and Gas Committee require a competent GAS-FITTER and PIPE LAYER, &c. Wages 30s. per week.

Applications, in own handwriting, together with copies of last testimonials as to character, abilities, &c., to be addressed, not later than the 26th inst., to the undersigned.

DAVID WHITE, Secretary and Manager.

TENDERS FOR LAYING WATER-MAINS.

THE Bangor Local Board, Water, and Gas Committee invite TENDERS for LAYING, &c., about 2900 lineal yards of 7-in. WATER-PIPES, with lead joints.

Tenders to be addressed "The Chairman, Water and Gas Offices, Bangor, Carnarvonshire," not later than the 31st inst.

The Committee do not bind themselves to accept the lowest or any tender.

Further particulars can be had on application to

DAVID WHITE, Secretary and Manager.

Jan. 17, 1880.

TO GAS ENGINEERS.

THE Directors of the Sheffield United Gaslight Company require the services of a Resident ENGINEER. The requisite qualifications are a thorough Practical Knowledge of Engineering, Preparation of Plans, and Construction of Works; the Manufacture and Distribution of Gas; and of Chemistry as applied to its Manufacture and Purification; also of the Making of Sulphate of Ammonia.

Applications, not later than the 14th prox., to be addressed to the Chairman of the Company, stating qualifications, age, salary required, references, &c

Testimonials in the first instance are not required.

Offices, Commercial Street, Sheffield, Jan. 10, 1880.

GAS COKE.

A LARGE QUANTITY required for delivery over a period of nine months.

Address, with price per ton into trucks at railway station, to G. J. EVESON, Gas, Coal, and Cannel Contractor, BIRMINGHAM.

TENDERS FOR SULPHATE OF AMMONIA.

THE Directors of the Cork Gas Consumers Company are prepared to receive TENDERS for all the SULPHATE OF AMMONIA to be manufactured at their Works during the year 1880.

Delivery f.o.b. Cork.

Probable quantity, 100 tons. Payment, net cash on delivery. Prices to be fixed on basis of 24 per cent. Ammonia, and tenders to state whether packages are to be supplied free by sellers.

Tenders will be received up to Friday, Feb. 6, 1880.

By order,

DENNY LANE, Secretary.

Company's Offices, 72, South Mall, Cork, Jan. 17, 1880.

In the Press, Third Edition of

IMPROVEMENTS IN GAS APPARATUS.

By GEORGE ANDERSON.

With 22 Illustrations of Retorts, Purifiers, &c., &c.

Re-written and enlarged, with a chapter on the "Purification of Gas," by Mr. R. H. PATTERSON, late Metropolitan Gas Referee.

To be had of WALTER KING, "JOURNAL OF GAS LIGHTING" Office, 11, Bolt Court, FLEET STREET, E.C.; or of the Author, 35A, Great George Street, WESTMINSTER.

N.B.—Orders received before Feb. 14—when the type will be scattered—4s.

SPENT OXIDE.

TO BE SOLD by Tender, a quantity of SPENT OXIDE, loaded into railway trucks or boats at Ashton-under-Lyne.

Samples and any further particulars may be had on application to the undersigned, to whom tenders must be delivered not later than Tuesday, the 27th inst.

D. CLARKE.

Gas-Works, Ashton-under-Lyne, Jan. 9, 1880.

PURIFIERS.

FOR SALE—Four Purifiers, as they stand at the West Ham Gas-Works, Stratford, Essex, 14 ft. by 14 ft. by 5 ft. deep (inside measure), with Wood Sieves complete. 12-in. Connections, for working straight through and round again.

Ten 12-in. Valves, part Donkin's and part Wales and Robinson's make.

Wrought-Iron Girders and small Crab to each Purifier, for lifting cover; 4-in. Air Valves; Holding-down Screws, &c., all in good working condition, having been repaired, cleaned, and made ready for use, and capable of doing a large amount of work. Bottoms are in 9 plates, sides, 4 corner plates, 2 intermediate plates; lutes cast on to side plates.

Application to be made to Mr. EDWARD H. THORMAN, Engineer, West Ham Gas-Works, STRATFORD, E.

THE Corporation of the Borough of Stafford are prepared to receive TENDERS for the Supply of RETORTS and FIRE-BRICKS which they may require during the ensuing Twelve months. Tenders to be sent in on or before the 24th inst., addressed to the undersigned, and endorsed "Tender for Fire-Goods."

JNO. STORER, Manager.

Gas-Works, Stafford, Jan. 10, 1880.

BOROUGH OF SALFORD.

GAS-WORKS CONTRACTS.—EXTENSION OF TIME.

THE Gas Committee have extended the time for delivering tenders for Contracts Nos. 18, 24, and 26, to Friday, the 30th inst., at 9 a.m.

The time for tendering for the other contracts remains as already advertised.

By order,

CHRIS. MOORHOUSE, Town Clerk.

Town Hall, Salford, Jan. 16, 1880.

GRAND JUNCTION WATER-WORKS COMPANY.

ISSUE OF NEW CAPITAL, £50,000 NOMINAL VALUE.

MESSRS. Edwin Fox and Bousfield are favoured with instructions from the Directors to submit to public competition, at the Cannon Street Hotel, on Thursday, Jan. 22, at Two, in Lots to suit all classes of buyers, One Thousand ORDINARY £50 SHARES of the Grand Junction Water-Works Company, bearing interest at 7 per cent., being the first portion of additional capital authorized to be raised under the provisions of the Grand Junction Water-Works Act, 1878.

Particulars—now ready—may be obtained of Messrs. Bircham and Co., Solicitors, 46, Parliament Street, S.W.; of E. O. Coe, Esq., the Secretary, at the Offices, 65, South Molton Street, W.; and of Messrs. Edwin Fox and Bousfield, 99, Gresham Street, Bank, E.C.

THE NEW RIVER, the most unique trading Corporation in the world, standing pre-eminent among all the great Water Companies of the kingdom, having a revenue, annually increasing, derived from land and water, &c., amounting to over £400,000 a year, with vast prospective advantages.

MESSRS. Edwin Fox and Bousfield will sell, at the Mart, on Wednesday, Jan. 28, at Two, in 35 Lots, exceedingly valuable Freehold Estates and Shares in the New River, unquestionably the choicest home investment of this or any other age, comprising Two Fifteenth Parts of a King's Share and 15 £100 New Shares, fully paid, the dividend in respect of which, up to Midsummer last, amounted to about £450 per annum.

Particulars may be obtained at the Mart; of Messrs. Frere, Foster, and Frere, Solicitors, 28, Lincoln's Inn Fields; and of Messrs. Edwin Fox and Bousfield, 99, Gresham Street, Bank, E.C.

TO IRONFOUNDERS AND MANUFACTURERS.

THE Gas Committee of the Warrington Corporation are prepared to receive TENDERS for the Supply and Erection, on their new Works at Warrington, as follows, viz.:—

Contract No. 4.—Six PURIFIERS, 20 ft. square, with dry Centre-Valves and 18-in. Connections.

Contract No. 5.—About 62 Tons Cast-Iron COLUMNS and GIRDERS, and about 33 Tons Malleable-Iron GIRDERS.

Plans and specifications may be seen on application to the undersigned, in whose hands sealed tenders, endorsed (for respective contracts), must be lodged on or before Thursday, Feb. 12 next.

JAMES PATERSON, C.E., Engineer.

Gas-Works, Warrington, Jan. 17, 1880.

TO GASHOLDER-TANK BUILDERS.

THE Directors of the Kingston-upon-Thames Gas Company are prepared to receive TENDERS for the Construction of a Brick TANK, 114 ft diameter and 25 ft. deep.

Specifications and plans may be seen on application to the Engineer at the Works, Lower Ham Road.

Tenders to be sent in on or before Wednesday, Jan. 21, 1880, addressed to the undersigned, and endorsed "Tender for Tank."

The Directors do not bind themselves to accept the lowest or any tender. By order,

W. A. FRICKER, Secretary.

Gas Offices, Church Street, Kingston, Jan. 9, 1880.

PORTSEA ISLAND GAS COMPANY.

THE Directors are desirous of receiving TENDERS for the following MOUTHPIECES, Tangye's patent, in good order and nearly new; taken down where West's system is now being adapted:—

Sixty 21 in. by 15 in. Oval on back to 18 in. Circular in front.

Ten 16 in. Circular.

Seventy 20 by 13 D's; all 15 in. deep from flange to face, with Sockets cast on for 6-in. Ascension-Pipes. Suitable for Beds of Sevens or Fives.

S. B. DARWIN, Secretary.

NOTICE TO MANAGERS OF GAS COMPANIES.

THE LAW UNION FIRE AND LIFE INSURANCE COMPANY, of No. 126, Chancery Lane, London, grants Policies of Insurance on Gas-Works, and Buildings connected therewith, which cover risk of explosion and spontaneous ignition of Coal, on very advantageous terms. Full particulars will be sent post free on application to

FRANK M'GEDY, Secretary.

126, Chancery Lane, London.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

EDWARD BROOKE AND SONS,

FIELDHOUSE FIRE-CLAY WORKS, HUDDERSFIELD,

MANUFACTURERS OF

GAS-RETORTS, FIRE-BRICKS, &c.,

Which have been extensively used for 30 years in the construction of Glass Furnaces, where the heat is five times greater than in Gas Ovens; superior to any Retorts or Fire-bricks in the market for standing intense heats, and not contracting.

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

Now ready, Second Edition, price 7s., by post 7s. 3d., the

GAS MANAGER'S HANDBOOK.

By THOMAS NEWBIGGING, M.I.C.E.

Orders to be sent to

WALTER KING,

11, BOLT COURT, FLEET STREET, LONDON, E.C.

Now Ready, Price One Guinea,

PRECEDENTS IN PRIVATE BILL LEGISLATION

AFFECTING GAS AND WATER UNDERTAKINGS.

COMPILED BY MR. G. W. STEVENSON, C.E., F.G.S.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

GASHOLDER—30 ft. by 14 ft.—for Sale; Contents 10,000 cubic feet. Also the Framing and Sheets of a similar Gasholder, taken down in large pieces. Very suitable for roofing purposes.

Apply to the MANAGER of the St. Andrew's Gas Company, FIFE.

THE Exeter Gaslight and Coke Company have for SALE Four 12-ft. square PURIFIERS, with Lifting Crane, Valves, and Connections. The whole in working condition, and to be removed from their present position by the purchaser.

Any further information may be obtained on application to the Engineer, at the Basin Station of the Company.

By order,
W. A. PADFIELD, Secretary.

Gas Offices, North Street, Exeter,

THE Gloucester Gas Company, ceasing to manufacture gas at their old works, will have the undermentioned APPARATUS for Sale about the beginning of August, viz.:—

110 Mouthpieces, D-shape, 13 in. by 22 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. 28 Mouthpieces, D-shape, 16 in. by 20 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12 in. Slide-Valves and 12 in. Connections.

Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12 in. Connections.

Exhauster (Jones) to pass about 15,000 feet per hour.

Exhauster (Beales) to pass about 25,000 feet per hour.

Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.

4-horse power Horizontal Steam-Engine.

Three 4-in. Pumps, with cranked Shafting and a pair Mitre Wheels.

Set of four Purifiers, 12 ft. by 12 ft. by 4 ft., with 12-in. Centre-Valve (Cockeys), and Connections and Lift complete.

Station-Meter by A. Wright and Co., London, with three 12-in. Slide-Valves, and 12-in. Bye-Pass and Connections, to pass about 25,000 feet per hour.

Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.

Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.

Two 12-in. Governors, by Wright, London, with 12-in Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.

For further information, &c., apply to the undersigned.

R. MORLAND, Engineer.

TO GAS COMPANIES.

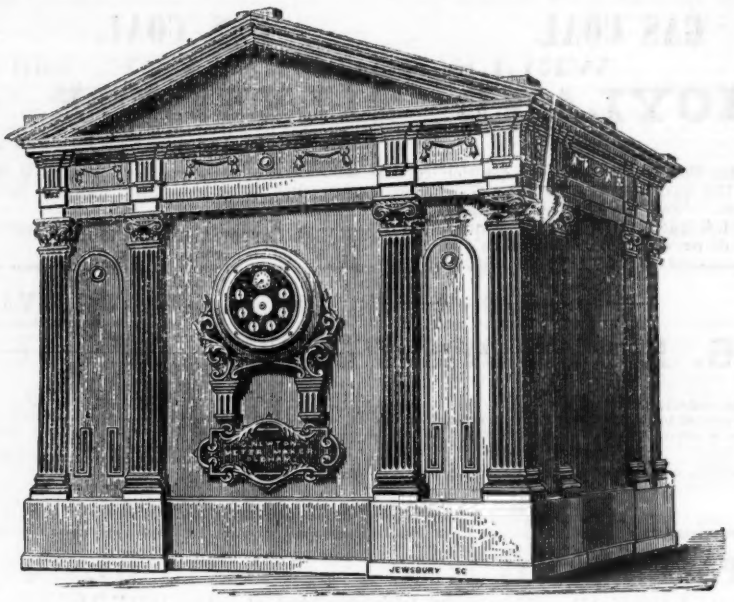
GEORGE McKAIG,
MANUFACTURER OF
GAS-PURIFYING WOOD SIEVES,
153, CLEVELAND STREET,
DONCASTER.

It requires but one trial to prove the Superior Make, Strength, and Durability of these Sieves.

CARRIAGE PAID.

J. & H. ROBUS,
BUILDERS AND CONTRACTORS
FOR THE ERECTION AND REBUILDING OF GAS AND WATER WORKS,
RETORT-SETTING—A SPÉCIALITÉ.
ROBUS'S IMPROVED RETORT-SETTINGS, guaranteed to Carbonize a large amount of Coal with a small per cent. of Fuel.
ESTIMATES GIVEN FOR MAIN-LAYING.
N.B.—All kinds of Fire Goods and Gas Apparatus supplied on the shortest notice.
Address:—J. & H. ROBUS, BELL GREEN, CATFORD, LONDON, S.E.

GEORGE NEWTON,
UNION STREET WEST, OLDHAM,



MANUFACTURER OF
SQUARE STATION-METERS, with PLANED JOINTS;
ROUND STATION-METERS, WITH CAST-IRON STANDS;
WET AND DRY CONSUMERS GAS-METERS, GOVERNORS, &c.

GAS *v.* ELECTRIC LIGHT.
WIGHAM'S PATENT LIGHTHOUSE GAS-BURNERS,
For Street Lighting and the Illumination of Large Halls, Factories, Ship Yards, &c., where Powerful Light is required.

These Burners have been adopted by a School Board, having large school-rooms in charge, because of their high illuminating power and the facilities they give for perfect ventilation. The actinic power of these Burners is such that they are used successfully for Photography and Photo-Lithography.

SOLE MANUFACTURERS:
J. EDMUNDSON & CO., Gas Engineers, 19, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.

FOR CERTAIN EXPOSED SITUATIONS
Such as in Chemical-Works, Bleach-Works, badly-ventilated Stables, Pickling-Works, and for use in some sea-side Towns,

THE IMPERIAL METER COMPANY'S
DRY METERS

Are fitted into water-tight seasoned wood outer cases.

The principal London Gas Company, having a large number of these Wood-cased Dry Meters, find, as the result of long experience, that the inner or tin cases are uninjured after the Meters have worked many years exposed to deleterious influences.

WET AND DRY GAS-METER WORKS, KING'S ROAD, ST. PANCRAS, N.W.
Formerly also (Walter Ford) at Gray's Inn Road.

ECONOMY IN THE PRODUCTION OF GAS.

PLUTONIC CEMENT,

FOR JOINTING AND REPAIRING RETORTS AND OVENS in ACTION AND out OF ACTION.

A Pamphlet on the advantages of the above, with Modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,

WILLIAM RICHARDSON, Gas and Hydraulic Engineer, CHARLES HENRY STREET, and BISSELL STREET, BIRMINGHAM.

THE WIGAN COAL & IRON COMPANY,

LIMITED,

DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN,

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

GAS COAL. GAS COAL. GAS COAL.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise 2000 tons per day of REAL OLD SILKSTONE GAS COAL.

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

NO MORE WASTE LIME! SAVE THE VALUABLE PRODUCT!

G. R. HISLOP'S PATENT REGENERATIVE PROCESS

Most Effectively and Economically restores this waste *ad infinitum*.

The Patentee having devoted more time and attention to this subject than perhaps any other person living, is now in a position to recommend the adoption of this process to Gas Companies and Corporations with the utmost confidence in its practical utility, convenience, and economy. 1st. It restores the spent Lime at from one-third to one-half its original cost, apart from its undoubted convenience and the economy of space. 2nd. There is practically no limit to the duration of the Lime. 3rd. The cost of apparatus for the introduction of the process is very moderate and exceedingly durable. 4. The Patentee supplies special bricks and castings, erects and proves the process on the most favourable terms.

The process, in operation, may be seen at the Corporation Gas-Works, Paisley, where the Lime has been restored 120 times. Inspection is cordially invited.

For Terms, apply to GEO. R. HISLOP, F.C.S., Engineer, Gas-Works, PAISLEY, N.B.

PARIS EXHIBITION, 1878.

THREE MEDALS AND HONOURABLE MENTION HAVE BEEN AWARDED TO

JOSEPH CLIFF & SONS

For their Various Exhibits, amongst which is a

SILVER MEDAL FOR THEIR PATENT MACHINE-MADE RETORTS AND FIRE-BRICKS,

Being the Highest Honour given for this class.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

Near LEEDS,

London Wharf: No. 4 inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

THE

GAS & WATER ENGINEERS BOOK OF REFERENCE.

BY

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SECOND EDITION.

The first Edition of the *Gas Engineers Book of Reference* was published fourteen years ago, and it has long since been out of print. The present Edition has been almost entirely re-written, and it may be considered a business Treatise on Practical Gas Engineering, and there is, besides, a section devoted to Heating by Hot Water Circulation.

There are articles upon each branch of Gas Manufacture, together with Specifications, Memoranda, Rules, and Information useful to Engineers.

Price of the Book, 4s.; of the Companion, with Detailed Costs, 1s.

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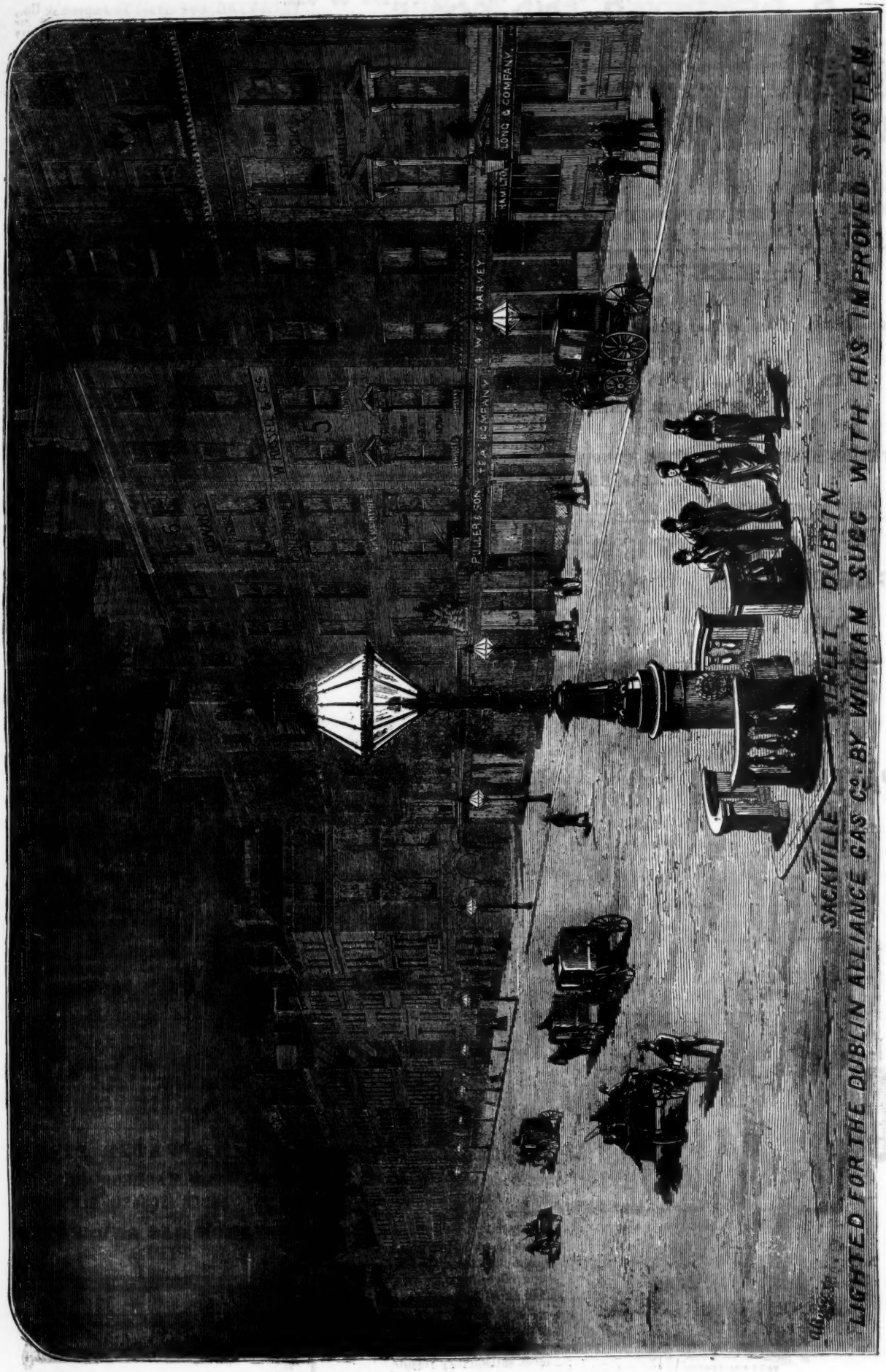
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WOOD SIEVES FOR PURIFIERS,

WITH TAPER OR PARALLEL BARS,

MADE BY SPECIAL MACHINERY.

SCRUBBERS FILLED WITH BOARDS,

On our approved principle, for the extraction of Ammonia.

Prices on application. References to First-Class Engineers.

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JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

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NEWGATE STREET, LONDON.

STATION-METERS GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

J. & J. BRADDOCK,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY CONSUMERS GAS-METERS,

OF THE HIGHEST EXCELLENCE ONLY;

ROUND STATION-METERS,

ON CAST-IRON STANDS;

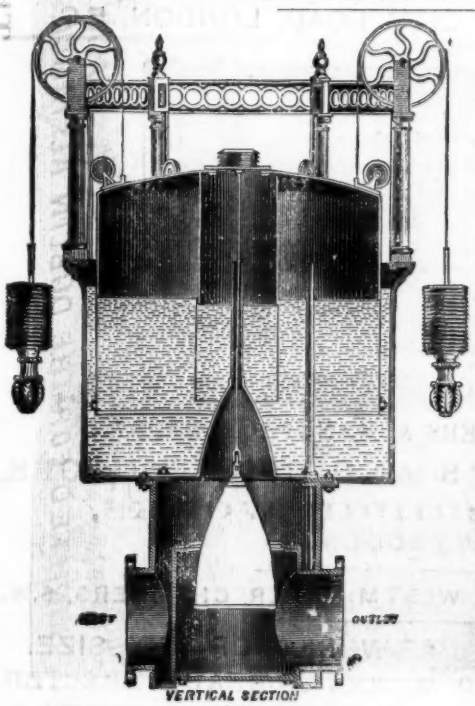
SQUARE STATION-METERS,

WITH PLANED JOINTS.

Messrs. Braddock beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 30-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

HENRY LYON,

MECHANICAL AND CONSULTING GAS ENGINEER,

NORWOOD, NORTHENDEN ROAD,

SALE, NEAR MANCHESTER.

SANDELL AND SON,

PUBLIC ACCOUNTANTS,

2, GREAT GEORGE STREET, WESTMINSTER.

Sandell and Son having been engaged during the past 25 years in Gas Companies Accounts, either in Preparing or Investigating Statements for Parliamentary Applications, Arbitrations, and otherwise, offer with confidence their Services for similar purposes.

Mr. ROBERT DEMPSTER,

CONSULTING GAS ENGINEER,

ELLAND, near HALIFAX,

May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations is both extensive and reliable.

ALFRED LASS, F.I.Accts.,

SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,

30, GRACECHURCH STREET, LONDON.

Accounts Analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

HARPER & MOORES,

PROPRIETORS OF THE

BEST STOURBRIDGE CLAYS,

STOURBRIDGE.

Manufacturers of all Descriptions of

BEST STOURBRIDGE FIRE-BRICKS, LUMPS, AND CLAY RETORTS

Of all Dimensions for Gas-Works,

GLASS-HOUSE POTS & CRUCIBLES

Established 1836.

The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture. Silver Medal, Paris, 1878.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Manufacture and keep in stock at their works (also a large stock in London) PIPES and CONNECTIONS 1½ to 48 inches in diameter; and make to order Retorts, Purifiers, and Tanks, with or without planed joints, Columns, Girders, Special Castings, required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

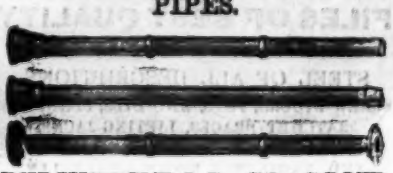
Note.—Syphons and Covers are joint-faced if required, doing away with millboard and iron boring, or Syphons made without Covers, a socket being cast on and fitted with a small plug about 6 inches in diameter with lead joint. In either way preventing leakage.

GAS AND WATER PIPES.

WILLIAM MacLEOD & CO.,

30, ST. ENOCH SQUARE, GLASGOW.

CAST-IRON GAS AND WATER PIPES.



DELIVERY F.O.B., GLASGOW.

Prices on application.

C. & W. WALKER'S
WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,
DONNINGTON, NEAR NEWPORT, SHROPSHIRE.
FINSBURY CIRCUS, LONDON.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

ESTABLISHED IN 1860.
BENJAMIN CARPENTER,
THE ORIGINAL MANUFACTURER OF THE IMPROVED
WOOD SIEVES
FOR
GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,
22, HERMES STREET, PENTONVILLE ROAD,
LONDON, N.

The Dunston Engine Works Co.,
GATESHEAD-UPON-TYNE.
Are the Sole Manufacturers of
Archer's Patent Hoists,
ALSO OF
Archer's Patent Stone Breaker,
AND OF
Archer's Patent Ore Crusher & Pulveriser,
The last-named Machine (without the Pulveriser) makes the best and most durable Coke Breaker.

TUBES

TUBES AND FITTINGS
For Gas, Steam, and Water, Galvanized, Enamelled, or Coated by Dr. Angus Smith's Patent Process.
Gas-Fitters Tools, Brass & Copper Work, Socket-Pipes, Roofing, and all Kinds of Ironwork for Gas and Water Works.
JOHN SPENCER,
VULCAN TUBE-WORKS,
WEST BROMWICH, STAFFORDSHIRE.
LONDON OFFICE:
97, CANNON STREET, E.C.
J. E. & S. SPENCER, Agents.

Gold Medal Awarded, Paris Exhibition, 1878.

THOMAS TURTON AND SONS,
SHEAF AND SPRING WORKS,
SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY FOR ENGINEERS,
STEEL OF ALL DESCRIPTIONS,
SCREW STOCKS, TAPS, AND DIES, SPANNERS,
RATCHET BRACES, LIFTING-JACKS,
ANVILS, VICES,
AND ENGINEERS TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET E.C.

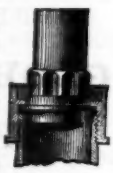
GEORGE ORME & CO.,
ATLAS METER-WORKS, OLDHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
STATION-METERS, GOVERNORS,
PRESSURE AND EXHAUST REGISTERS,
LAMP-METERS IN CAST-IRON BOXES,
And every Description of Gas Apparatus.

LONDONDERRY GAS COALS
DIRECT FROM THE
MARQUESS OF LONDONDERRY'S COLLIERIES.
COUNTY OF DURHAM.
For Prices and Particulars, apply to
MR. S. J. DITCHFIELD,
LONDONDERRY OFFICES, SEAHAM HARBOUR, COUNTY OF DURHAM.
London Agents: Messrs. LAMBERT BROS., 85, GRACECHURCH ST., E.C.

W. PARKINSON & CO.,
SOLE AGENTS FOR AND MANUFACTURERS OF
FOULGER'S PATENT SEAL UNIONS,
As Supplied to The Gaslight and Coke, Commercial, South Metropolitan, and other Companies.

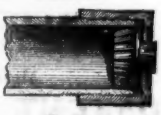
These Unions practically place a Gas Company's property under lock and key, by rendering it impossible to disconnect at any joint at which gas can be obtained unregistered, without destroying the Company's Seal.

In fixing the Union (one being required on the main cock and another on the inlet only), some molten sealing-wax is poured into the recess on cap, and whilst hot impressed with Foulger's patent tong-shaped die, having the Gas Company's title engraved thereon; the wax being forced into the flutings on the lining, instant destruction of the Seal accompanies any attempt at disconnection.


SECTION.

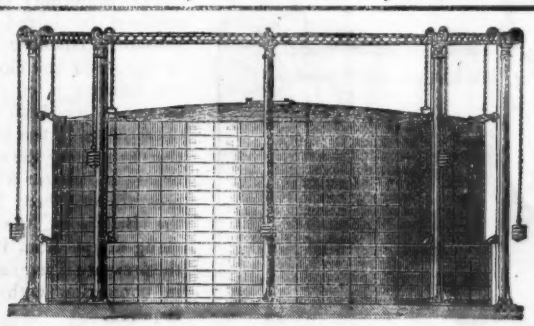
FOULGER'S PATENT SEAL CUTTING-OFF CAPS

Cannot be taken off without destroying the Company's Seal. A tapered fluted plug (having been white-leaded or puttied) is inserted in the service-pipe. The cap (already filled with sealing-wax) is then screwed over, and tightens on a washer on the flange of plug. The wax is then warmed, and stamped with the engraved die. Absolute security against fraud and escape is thus obtained.


SECTION.

A great advantage will also be recognized in stopping the gas instantly with the plug, and consequent immunity from the present source of danger occasioned by escape during fitting the ordinary cap, frequently in a confined position, and often occupying a considerable time.
Small additional cost over existing connections.

COTTAGE LANE, CITY ROAD, LONDON, E.C.



J. T. B. PORTER & CO.,
GAS ENGINEERS & MANUFACTURERS,
IRONFOUNDERS AND CONTRACTORS,
GOWTS BRIDGE WORKS,
LINCOLN.

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.
REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

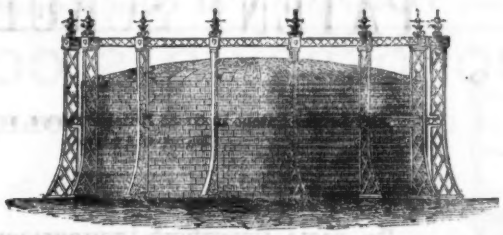
BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS, WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

6, WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,

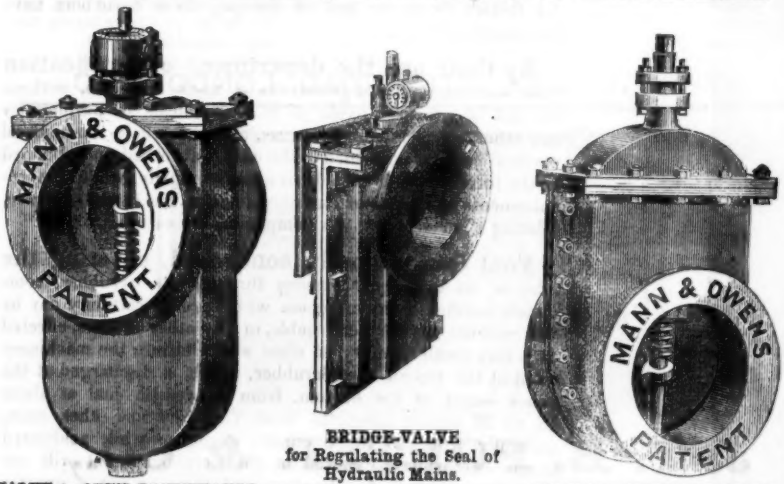
HYDRAULIC, GAS, AND GENERAL ENGINEERS,

WHITEFRIARS STREET, LONDON, E.C.

Sole Manufacturers of MANN & OWENS'

PATENT SCREW & CAM GAS-VALVE,

Protected by Royal Letters Patent in England, France, Belgium, & the United States of America.



BRIDGE-VALVE for Regulating the Seal of Hydraulic Mains.

VALVE to OPEN DOWNWARDS. VALVE to OPEN UPWARDS.

The SPECIAL ADVANTAGES of MANN AND OWENS' PATENT VALVE are as follows:—

1. Its non-liability to become set fast through varying temperature or from the deposit from crude gas. 2. It is made absolutely gas-tight by the simple action of a screw and cam. 3. Inconvenience through the breakage of springs or wedges setting fast cannot arise. 4. The face of the Valve is scraped and cleaned of any solid matter at each operation of opening or closing.

The Valve can be had to work either in a Vertical or Horizontal position.

Every Valve is carefully tested under pressure, and warranted perfectly sound and gas-tight.

INSTRUCTIONS FOR ORDERING.

State whether required for above or below ground, if Double Flange or Socket and Spigot Valves are wanted, or with loose Flanged Socket and Spigot pieces.

The Prices include Indicators to show extent to which Valve is open.

Also makers of PILLAR-VALVES, SELF-ACTING BYE-PASS VALVES, OUTSIDE RACK AND PINION VALVES, HYDRAULIC-MAIN VALVES, DISC-VALVES, &c.

Every description of Pumping Apparatus, Hydraulic Lifts, &c., suitable for use in Gas-Works, made to order.

PRICES, SIZES, AND FULL PARTICULARS, WITH COMPLETE ILLUSTRATED CATALOGUE, FURNISHED ON APPLICATION.

THOMAS CARR & SON,

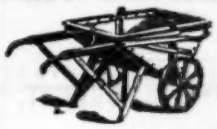
MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,

COTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.

Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

PRICE'S PATENT COKE & COAL BARROW



effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

Prices are Reduced.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

JAMES NEWTON & SONS,

(Established 1820,)

FIRE-BRICK AND TILE MERCHANTS,

Wholesale and for Exportation,

FALCON DOCK, 78 AND 79, BANKSIDE,

SOUTHWARK, LONDON, S.E.,

DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for

GAS AND WATER WORKS.

GAS COAL.

THE Tawd Vale Colliery Company Limited, are prepared to Contract for the Supply of their superior Arley and other GAS COALS, and to send samples to the order of Gas Engineers and others, or complete analysis on application. Shipped at Liverpool, Preston, Fleetwood, Garston, or Birkenhead.

Mr. James Paterson, C.E., F.G.S., in his analysis of T. V. Arley Coal, says: "Some parts merge into a semi-Cannel; Gas per ton, 10,300 cubic feet; illuminating power, 16·96 candles; coke of high quality, 1431 lbs. per ton."

Collieries, Skelmersdale, near Ormskirk; Offices, 5, New Hall, Old Hall Street, LIVERPOOL.

Less Heat, No Smoke,

White Light, & Economy

SPECKSTEIN & LAVA Gas-Burner Fabricants

On the most approved French and German principles.

These Burners can be made to consume from 1¼ feet to 20 feet of gas per hour, and to give a light from 4 to 150 candle power.

Terms and Discount on application.

Catalogue, 6d. Sample Burner, 1s.

AUGUSTUS WESTWOOD & Co., COMMERCIAL CHAMBERS, WEST BROMWICH.

"TANNIC GELATINE,"

FOR

REMOVING AND PREVENTING INCRUSTATION OF EVERY DESCRIPTION OF STEAM BOILERS; ALSO CORROSION.

Manufactured only by

WILLIAM RICHARDSON,

GAS ENGINEER,

94, CHARLES HENRY STREET, BIRMINGHAM.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

MR. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

THE

SILBER LIGHT COMPANY,

MANUFACTURERS OF

SILBER'S PATENT TUBULATED BURNERS

FOR

COAL OR AIR GAS,

And of SILBER'S BAT'S-WING GAS-BURNERS and every variety of Gas-Fittings.

ALSO MANUFACTURERS OF

EVERY DESCRIPTION OF LAMPS (burning Colza Oil, Petroleum, Paraffin, or Kerosene) FOR DOMESTIC PURPOSES, STREETS, RAILWAY STATIONS, SHIPS, &c., &c.

FIG. 1.
Silber's Patent Tubulated Gas-Burner, drawn full size.

FIG. 2.
Section of Silber's Tubulated Gas-Burner, the arrows indicating the currents of air to the flame —two externally and two internally.
Dr. Wallace, F.R.S.E., Gas Analyst of Glasgow, says of this burner: "It gives the steadiest flame of any Argand yet constructed."

FIG. 3.
Silber's Tubulated Gas-Burner with glass bulb or vase beneath, and with larger inlet than aggregate outlet area, by which means the illuminating power for 5 cubic feet of 16-candle-light gas is increased one candle.

The Silber Tubulated Gas-Burner offers the following advantages over existing Argand Gas-Burners:—

1. It affords more light for 5 cubic feet of gas.
2. It is made of brass, and so put together that there is no liability of its melting, or coming to pieces in any other way, as burners made of soft metal are apt to do.
3. It is capable of burning from 4 to 7 cubic feet of gas per hour (by using chimneys of different lengths), and although the consumption be increased, **the illuminating power per cubic foot of gas remains almost quite constant.**
4. With the glass bulb or vase, as shown in fig. 3, the illuminating power for 5 cubic feet of 16-candle-light gas is **increased one candle.**

FIG. 4.
Silber's Bat's-Wing Gas-Burner.
The results obtained from this Burner are amongst the best obtained from any flat-flame Burners yet introduced.

FULL PARTICULARS & ENGRAVINGS

Forwarded on application to

THE SILBER LIGHT COMPANY,

49, WHITECROSS STREET,

LONDON, E.C.

FIG. 5.
Silber's Bat's-Wing Burner, with Opal Gas Moon.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

HARTHILL CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

THRASHBUSH CANNEL

12,530 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

OLD WEMYSS CANNEL

Yields 13,220 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERSPOON, FERGUSSON AND Co., 21, Lime Street, LONDON, E.C.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

W. RICHARDSON,

29, QUAYSIDE, NEWCASTLE-ON-TYNE.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of Londen in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

THE

SILICA FIRE-BRICK CO.,

OUGHTIBRIDGE

Near SHEFFIELD,

Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET, DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

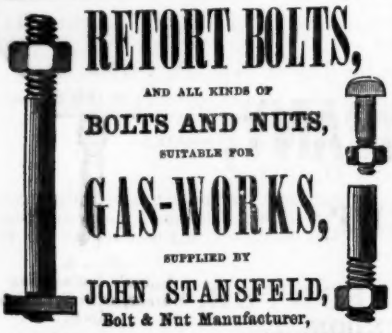
Agent in London, Mr. J. MANWARING, 101 Cannon Street, E.C.

M. BREMOND'S NAPHTHALINE PROCESS.

All negotiations respecting M. Brémond's patented process for preventing Deposits of

NAPHTHALINE

in Gas Main and Service Pipes should be addressed to Mr. W. H. BENNETT, 22, Great George Street, WESTMINSTER, S.W., or to M. BREMOND, Gas Engineer, Compania Madrilena de Alumbrado y Calefaccion por Gas, MADRID, who may be consulted upon all matters connected with the Gas Industry.



RETORT BOLTS,

AND ALL KINDS OF

BOLTS AND NUTS,

SUITABLE FOR

GAS-WORKS,

SUPPLIED BY

JOHN STANSFELD,

Bolt & Nut Manufacturer,

ALFRED ST., BOAR LANE, LEEDS.

FERRAND DAVIES,

148, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,

AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL,

AND

NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.

Analyses and Quotations on application.

WILSON CARTER AND PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES:

TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

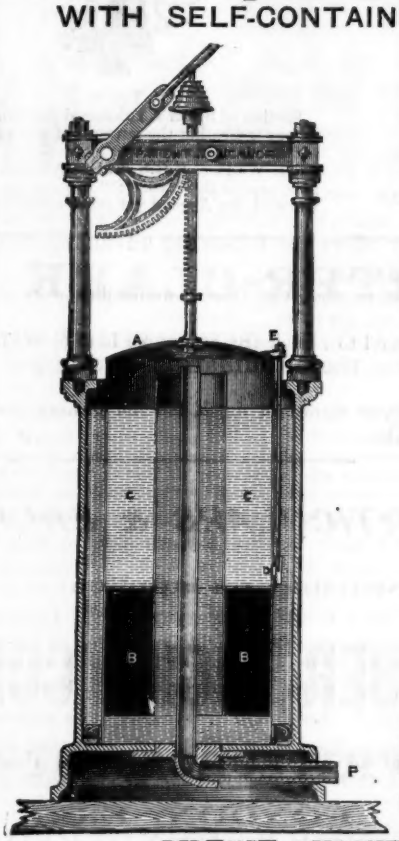
35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

GEORGE WALLER & CO.,

GAS AND HYDRAULIC ENGINEERS,

Patent Compensating Steam Governor,

WITH SELF-CONTAINED WATER-BALANCE.



This is the most efficient and perfect Governor yet made to control and regulate the speed of Engines and Exhausters according to the varying make of gas, and maintain a steady gauge, whether working level or with six inches of seal.

It is the only Governor that will effectually control Condensing and Compound Engines, especially when the Exhauster is on light work, and the Engine is large.

During the drawing and charging of Retorts, the Engine requires no attention—a matter of great importance in small works.

Descriptive Circular sent on application.

They are in use at
BECKTON,
HAMPTON WICK,
DUKINFIELD,
HARTLEPOOL,
RAMSGATE,
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See also advertisement, page 104.

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LIVESEY'S PATENT WASHER.

This apparatus effects the most intimate contact between the liquor with which it is supplied and the gas passing through it, resulting in the complete removal of all particles of tar, increasing the ammonia strength of the scrubber and condenser liquor, and removing a large proportion of other impurities—notably, carbonic acid. The Washer is intended to work in conjunction with a scrubber. It occupies little space, and is inexpensive. It has been in successful constant use for nearly three years, does not become clogged with tar or corroded by the action of the liquor or gases, it gives three inches of pressure, and only needs a supply of liquor to keep it in regular action without any further attention.

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CONTRACTORS FOR GAS & WATER WORKS, GENERAL ENGINEERS, IRONFOUNDERS & MANUFACTURERS OF

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S. C. & Sons undertake the entire erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the supplying and laying of MAINS.

They make a speciality of supplying every requisite whatever for Gas-Works, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

Manufacturers of MORRIS & CUTLER'S PATENT CONDENSER & CUTLER'S PATENT GAS-WASHER.

DESCRIPTION OF MORRIS & CUTLER'S PATENT CONDENSER.—The Condenser may consist of pipes arranged in tiers, or in any other form most convenient to the site available, each tier being connected with special connections, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. The Condenser itself may form the support for a high-level cistern. By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control. The Condenser may be seen in operation at the Brentford Gas-Works.

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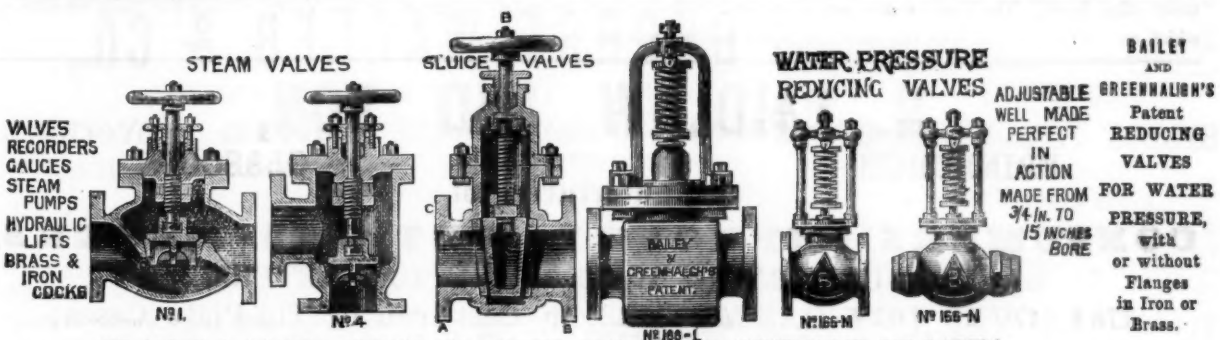
S. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.



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THE PORTER-CLARK PROCESS

FOR THE

SOFTENING AND FILTRATION OF WATER IN LARGE QUANTITIES, WITHIN SMALL SPACE, AT SMALL COST.

(*See* JOURNAL *of Jan.* 6, 1880.)

In an article upon the Swindon Water Supply, the *Wilts and Gloucestershire Standard* of Aug. 9, 1879, says:—

"All praise is due to the Company who have thus provided a water supply that, if it can be equalled, we are safe in saying cannot be surpassed. . . . For the information of all caterers for public health, we explain that the mode of so effectually Purifying and softening the really good and naturally wholesome water is the 'PORTER-CLARK PROCESS.' 'CLARK'S PROCESS' was known to be chemically admirable; the improvements, however, effected by Mr. Porter, mechanically, are curious as they are perfect."

The filtration is exquisite, and everything arrested is removed daily.

The Visiting Justices of the Kent County Asylum at Chartham on Aug. 29, 1879—

Resolved, "That a favourable testimonial be given to Mr. Porter for his system down to the present time, and that the Clerk forward a copy of this resolution to Mr. Porter." (50,000 gallons daily.)

The Visiting Justices of the Middlesex County Asylum, Banstead Downs, under date of Sept. 12, 1879—

Certify, "That up to the present time the 'PORTER-CLARK WATER-SOFTENING PROCESS,' which has been in operation at this Asylum for about two years, has satisfactorily answered the purposes for which it was intended." (60,000 gallons daily.)

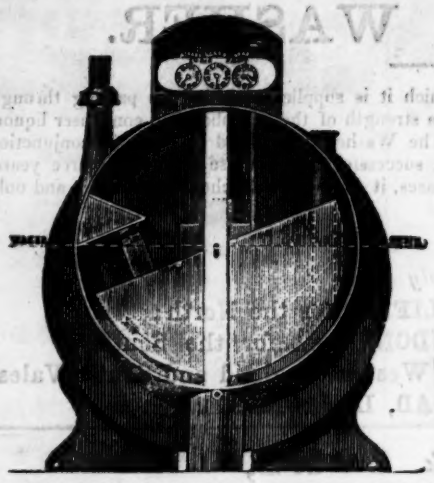
(See *The Times*, Aug. 23, 1877, Paper by Mr. F. J. Bramwell, F.R.S., Meeting of British Association, Plymouth.)

The Proprietor of the *Daily Chronicle* and *Lloyd's Weekly News* writes, Sept. 17, 1879—

"The 'PORTER-CLARK WATER-SOFTENING PROCESS,' erected by you at my paper-mill at Sittingbourne, continues to give satisfaction, and I no longer have any trouble with my steam-boilers. I am not yet working the filters up to their full capacity, only softening about 80,000 gallons per 24 hours, whereas I could easily do more than 120,000 gallons. I may add that it only requires one man to attend to the whole operation."

PATENTED BY JOHN HENDERSON PORTER, C.E.,

1 & 2, TUDOR STREET, BLACKFRIARS, LONDON, E.C.



THE

UNVARYING WATER-LINE GAS-METER.

(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."—THOS. G. BARLOW, C.E.

Over 120,000 in action.

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Branch Manufactories at DUBLIN and OLDHAM.

ALEXANDER WRIGHT & CO.,

55, 55a, & 56, MILLBANK STREET, LONDON, S.W.,

MANUFACTURERS OF

WET & DRY GAS-METERS & GAS APPARATUS,

AND SOLE MAKERS OF

WRIGHT'S REGISTERING PRESSURE GAUGE,

Which has for years been so extensively employed by Gas Companies and others, at home and abroad, have learned that inferior and imperfect dial papers bearing their name, for use with the above instruments, have been and are being produced for and sold by one or more other firms. The genuine dial papers are printed from plates accurately engraved by machinery, so that the scales are correct, which cannot be the case with the spurious papers mentioned above.

R. LAIDLAW AND SON,

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Manufacturers of

CONSUMERS IMPROVED WET GAS-METERS,

THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges,
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IMPROVED HYDRAULIC CRANES,

Effecting a great saving in the cost of discharging Coals from Vessels, Barges, &c. Several of these Cranes, with the necessary power, are now being erected at Beckton, Hull, and other Gas-Works.

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Sixteen recently erected at Beckton, applied to Covers 30 feet square.

SULPHATE OF AMMONIA APPARATUS,

IN SUCCESSFUL OPERATION AT THE NEW WORKS OF THE NEWCASTLE AND GATESHEAD GAS COMPANY, AND IN COURSE OF ERECTION AT THE CARLISLE CORPORATION GAS-WORKS.

Special "REGULUS COCKS" manufactured to stand Acid.

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JOHN ABBOT & CO., LIMITED,

2, SUFFOLK LANE, CANNON STREET, E.C., or PARK WORKS, GATESHEAD-ON-TYNE.

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